

Learning in the workplace: The case of air traffic control

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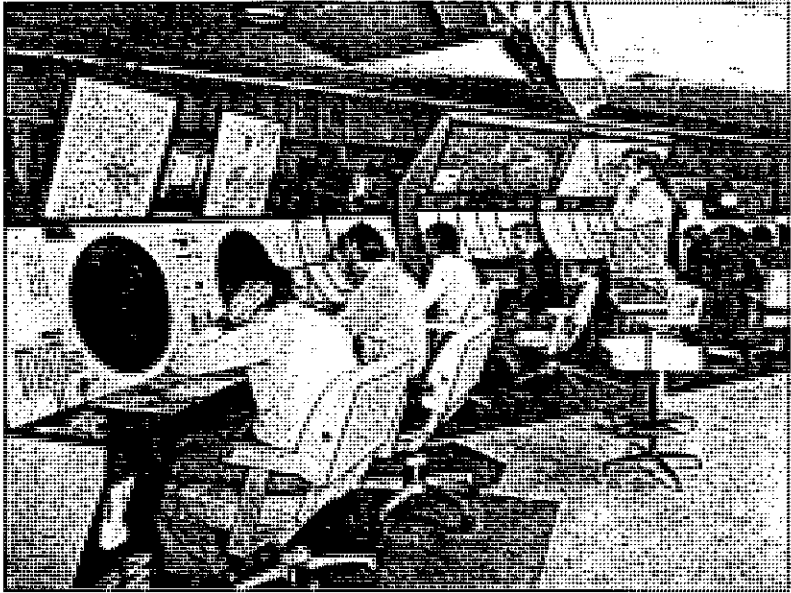
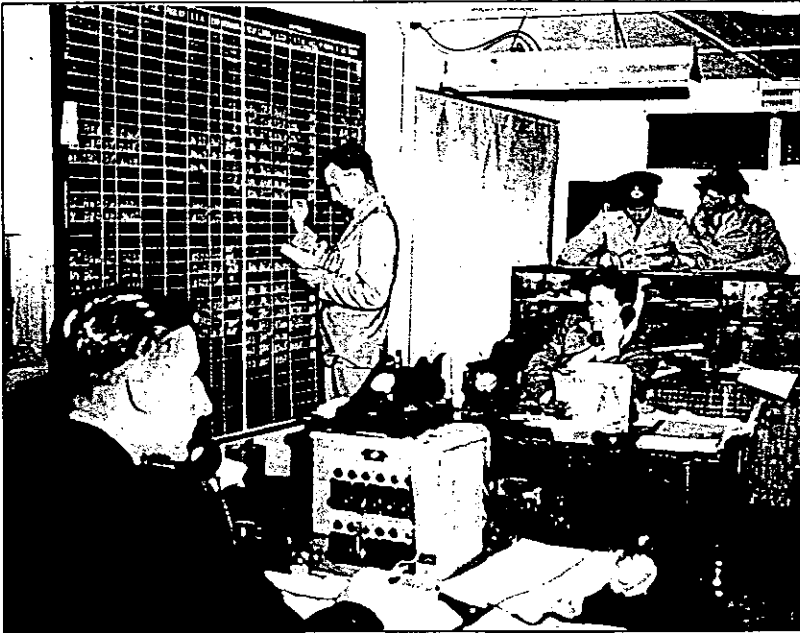
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One does not discover new lands without consenting
to lose sight of the shore for a very long time

(Andr  Gide)



Declaration

This thesis contains no material that has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the Thesis. To the best of my knowledge I believe that no material previously published or written by another person is cited except where due acknowledgment is made in the text of the Thesis.

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ABSTRACT

This Thesis is intended to make a contribution to the growing literature concerned with learning in the workplace. It presents a detailed analysis of learning in one type of work activity — air traffic control. This particular work activity was chosen because it embodies features that represent the future of work for many other industries (e.g., information service provision mediated by information technologies; a high reliance on communication skills and collaborative work; increasing complexity and intensity of the work activity), within an organisational context undergoing considerable change. The organisation chosen and the type of work selected provides an example of the kind of national policy reform that has been occurring in Australia over the past decade. It also provides an example of how change is strongly influencing the nature of the work. Within this organisation, technological and organisational reform is leading to changes in work practice and to changes in relationships between workers within the organisation and these have consequences for workplace learning.

This Thesis addresses the question: In what ways do organisational structures and cultures enable and constrain learning in the workplace? The basic premise of the Thesis is that the lived experiences of people at work are significantly influenced by their contexts (in organisations most commonly conceptualised as structures and cultures) and that these contexts are in turn reproduced or transformed by people. At the heart of this Thesis is a concern to understand how these processes interact so that we may create educative work environments in workplace organisations.

It is argued in the Thesis that learning occurs in a range of ways in the workplace, most notably, as formal and informal learning. Formal learning occurs as part of formalised and workplace accredited programs, embedded within the organisation's authority and accountability structure. This kind of learning (often referred to as training) has a finite end point, and results in a qualification or licence to undertake specific work activity. Learning also occurs informally, as part of everyday work and it too is influenced by organisational contexts. This study explores how changing organisational cultures and structures influence formal and informal workplace learning. By investing in certain cultural beliefs and values, for example, individuals within the workplace both enable and constrain their own opportunities for learning and those of workplace colleagues. Moreover, organisational structures (e.g., the design of work, including processes of authority and accountability) also enhance and inhibit learning opportunities. It is argued that as the pace of organisational and technological change continues to accelerate, greater attention needs to be given to the factors that enable and constrain both formal and informal learning so that learning becomes a continuous process embedded within everyday work practice. Continuous learning occurs, then, when individuals engage in learning processes continuously and where these processes are embedded within work activity and contexts (within structures and cultures). Continuous learning is important in

industries undergoing change and particularly in those workplaces characterised by high-performance work (such as air traffic control).

The Thesis is based on a qualitative study of learning in the air traffic control workplace. The data set is based on 100 semi-structured interviews conducted in three air traffic control workplaces, observations of air traffic control work practices, and the author's active participation as a training provider and process facilitator within a range of organisational change events. The study used an interpretive methodological approach including interviews and observations to attend to the features of social interaction. The data were examined also for the presence of structural and cultural phenomena. In this way, the study provides an explanation of the way in which social structure, culture and history interweave with the activity of learning at work and helps shape the nature and organisation of learning in work activity. The study seeks to extend existing literature and understanding by attempting to integrate concepts from psychological approaches to learning with situated understandings of the importance of contextual influences found in cultures and communities of practice, together with organisational theories of work organisation. Thus, the study offers a bridge between learning and organisational theory in a way that can assist both organisational designers and facilitators of workplace learning.

The research concludes that the ways in which organisational structures and cultures enable and constrain learning can be identified. Furthermore, it demonstrates that organisational change processes of recent years have fundamentally altered the ways in which people learn about the complex organisations and systems within which they work with both positive and negative results for learning. A model is presented that identifies and defines elements in the learning process and the ways in which structural and cultural contexts are implicated in those processes within the workplace. The model identifies structural and cultural elements that need to be present to achieve a goal of continuous learning and to thereby to make possible the creation of educative work environments.

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My life-partner David has also been actively involved in developing and strengthening the ideas contained in the Thesis. Husband, friend, soul-mate and editor, he sometimes questioned and challenged, always encouraged, and never stopped believing there was a "good story" in there somewhere. Thank you!

Preface

This is a story about the influence of context on learning in the workplace. Like most good journeys, exact details about the destination were not necessarily known on departure. I started this research interested in workplace learning, and, like many others, assumed that this meant formal on-the-job training programs. In commencing the data collection process, it soon became clear that, while worthy of attention, it was not the most interesting, or indeed the most important, learning occurring within the workplace under study. Indeed, it also became apparent that more was going on below the surface to account for why some, for example, workplace instructors embraced principles typically associated with adult learning and why others actively rejected them. As I interviewed air traffic controllers, researched ideas about learning and workplaces, and observed controllers undertaking their everyday work activity (which included training) I was struck by how important work context was in enabling and constraining, learning practices both within formal training as well as within everyday work practice. Furthermore, in researching changes occurring to work in general, and in high-reliability, high-technology, high-intensity workplaces in particular, the importance of informal learning and in creating educative workplace environments became more and more compelling.

Therefore, although this research started investigating formal learning in the workplace, it quickly moved focus to attend to the informal and the slippery linkages between them. As such, the Thesis discusses the role of context and its influence on learning. It does not discuss “formal” and “informal” workplace learning in a neatly packaged way, but instead draws on examples from both to explain the influence of context. The more I engaged in researching learning in this particular workplace, the more convinced I became of the importance of better understanding what contextual features enable and constrain opportunities for formal and informal learning in everyday work practice.

As an idea, I believe the promotion of educative work environments is important, absolutely necessary, and worthy of doing, in all workplaces. I feel fortunate to have had the experiences I have had in undertaking this research and to have participated in the significant change events heralding a future direction within this industry.

I hope you enjoy my story and can share in the excitement I feel about it.

Contents

SECTION ONE	1
1 INTRODUCTION	2
1.1 INTRODUCTION TO THE STUDY	3
1.2 THE IMPORTANCE OF WORK IN LIFE	3
1.2.1 <i>The rise of the "learning society"</i>	4
1.3 THE CHANGING SHAPE OF WORK ENVIRONMENTS	5
1.3.1 <i>Technological change and its impact on work</i>	6
1.3.2 <i>Globalisation</i>	6
1.3.3 <i>Changes to the internal organisation of work</i>	7
1.3.4 <i>The rise of "knowledge work" and high-performance work</i>	7
1.3.5 <i>The emergence of the high-technology, high-intensity, high-reliability workplace</i>	8
1.4 CONCEPTUALISING LEARNING IN THE WORKPLACE	13
1.4.1 <i>The "problem" of context</i>	14
1.4.2 <i>Defining learning in the workplace</i>	16
1.5 FOCUS OF THE STUDY	18
1.5.1 <i>Study aims</i>	18
1.5.2 <i>Research questions</i>	19
1.5.3 <i>Importance of the study</i>	20
1.5.4 <i>Summary of the process of the research</i>	21
1.6 ORGANISATION OF THE THESIS	21
1.7 CONCLUSION	23
2 REVIEW OF THE LITERATURE	24
2.1 INTRODUCTION	25
2.1.1 <i>Scope</i>	25
2.2 THE LEARNING THEORY LITERATURE	26
2.2.1 <i>Learning theories emphasising the individual and mind</i>	26
2.2.2 <i>Section summary</i>	30
2.2.3 <i>Sociocultural perspectives</i>	31
2.2.4 <i>Integrating cognitive and sociocultural perspectives</i>	34
2.2.5 <i>Empirical studies into learning in the workplace</i>	36
2.2.6 <i>Section summary</i>	37
2.3 THE ORGANISATION THEORY LITERATURE	38
2.3.1 <i>Structure as an element of organisation</i>	38
2.3.2 <i>Organisational learning</i>	42
2.3.3 <i>Critical organisational theory</i>	45
2.3.4 <i>Culture as an element of organisation</i>	46

2.4	INVESTIGATING WORK ORGANISATION	48
3	METHOD	50
3.1	INTRODUCTION	51
3.2	IN SEARCH OF A METHOD	51
3.2.1	<i>Procedures for verification in qualitative research design</i>	52
3.2.2	<i>Mapping the intersection between lived experience and context</i>	54
3.3	BACKGROUND TO THE RESEARCH	56
3.3.1	<i>Selection of sites to conduct the study</i>	58
3.3.2	<i>Phases of the Research</i>	58
3.3.3	<i>Process of data collection</i>	60
3.3.4	<i>Phases of data analysis</i>	64
3.3.5	<i>Protocols used in the Thesis</i>	66
3.4	SUMMARY OF VERIFICATION PROCEDURES USED IN THE THESIS	66
3.5	LIMITATIONS OF THE STUDY	68
3.6	CONCLUSION	68
	SECTION TWO	70
4	THE AVIATION INDUSTRY: CHALLENGE AND CHANGE	71
4.1	INTRODUCTION	72
4.2	THE AVIATION INDUSTRY AND GROWTH IN AIR TRAFFIC	72
4.2.1	<i>Changing technologies and globalisation in aviation</i>	73
4.2.2	<i>The importance of continuous inquiry in the aviation industry</i>	74
4.3	ATC IN AUSTRALIA	76
4.3.1	<i>The Practice of ATC work</i>	76
4.3.2	<i>Training for ATC work</i>	81
4.4	CONCLUSION	87
5	THE STRUCTURES AND CULTURES OF THE ATC WORKPLACE	89
5.1	INTRODUCTION	90
5.2	CHANGES TO THE ORGANISATION OF ATC WORK	90
5.2.1	<i>Changes in the formalisation and centralisation of ATC work</i>	91
5.2.2	<i>Changes to the centralisation of ATC work</i>	92
5.2.3	<i>Changes in differentiation and integration of job roles and tasks</i>	93
5.2.4	<i>The physical structuring of work activity</i>	96
5.3	CULTURES WITHIN ATC WORK	101
5.3.1	<i>Elements of culture in ATC work</i>	102
5.3.2	<i>Group memberships</i>	103
5.3.3	<i>Language and stories: Work as play and war</i>	109
5.3.4	<i>Myths and legends: Gun controllers and adrenalin junkies</i>	114

5.4	CONCLUSION	116
SECTION THREE		118
6	CONCEPTUAL STRUCTURE	119
6.1	INTRODUCTION	120
6.1.1	<i>Using Kolb's processes of learning as a framework</i>	120
6.2	A CONCEPTUAL FRAMEWORK FOR EVALUATING THE INFLUENCE OF CONTEXTS ON LEARNING IN THE WORKPLACE	126
6.2.1	<i>Experience as a process of learning</i>	127
6.2.2	<i>The importance of reflection for learning in the workplace</i>	128
6.2.3	<i>The role of conceptualisation for learning in the workplace</i>	129
6.2.4	<i>Experimentation in the workplace</i>	131
6.3	CONCLUSION	132
7	THE EXPERIENCE OF ATC WORK	134
7.1	INTRODUCTION	135
7.1.1	<i>The embedded nature of experience in learning: A cautionary note</i>	135
7.2	EXPERIENCING ATC WORK	136
7.2.1	<i>The temporality of ATC work</i>	139
7.2.2	<i>The complexity of ATC work</i>	142
7.2.3	<i>The affective experience of ATC work</i>	144
7.2.4	<i>The social experience of ATC work</i>	149
7.2.5	<i>Interdependent sentience</i>	152
7.3	CONCLUSION	153
8	REFLECTION IN THE WORKPLACE	154
8.1	INTRODUCTION	155
8.2	ATTRIBUTES OF REFLECTION IN THE EXPERIENCE OF ATC WORK	155
8.2.1	<i>The temporality of experience and reflection</i>	156
8.2.2	<i>The complexity of experience and reflection</i>	158
8.2.3	<i>Affective experience and reflection</i>	160
8.3	SOCIALLY REFLEXIVE PROCESSES AT WORK	162
8.3.1	<i>The spatio-structural organisation of reflection</i>	163
8.3.2	<i>Socially reflexive cultural practices</i>	166
8.4	CONCLUSION	170
9	CONCEPTUALISATION AND ATC WORK	171
9.1	INTRODUCTION	172
9.1.1	<i>Schemas and conceptualisations about the social world</i>	173
9.2	GROUPS, COLLECTIVE CONCEPTUALISATION AND CONTESTED CULTURES	176

9.2.1	<i>Working Approach and Enroute: Contested cultures across "The Room"</i>	177
9.3	INSTRUCTIONAL STRATEGIES AND CONCEPTUALISATIONS ABOUT LEARNING	181
9.4	BELIEFS ABOUT TRAINEE LEARNING AND PERFORMANCE	181
9.4.1	<i>Acting On</i>	183
9.4.2	<i>Working With</i>	185
9.4.3	<i>Working Against</i>	187
9.5	CONCLUSION	190
10	EXPERIMENTATION AND WORK ACTIVITY	191
10.1	INTRODUCTION	192
10.1.1	<i>Incidental and personal experimentation: Learning vicariously</i>	194
10.1.2	<i>Sharing incidental experimentation:</i>	195
10.1.3	<i>Intentional experimentation</i>	197
10.1.4	<i>Conclusion</i>	203
11	CHANGE AND ITS IMPACT ON PERFORMANCE AND LEARNING	205
11.1	INTRODUCTION	206
11.1.1	<i>Change in ATC work</i>	206
11.1.2	<i>Changes in the temporal experience of ATC work</i>	208
11.1.3	<i>Changes in the complexity of work</i>	211
11.1.4	<i>The affective experience of workplace change</i>	215
11.1.5	<i>Changes to the sociality of ATC work</i>	220
11.1.6	<i>Conclusion: Where to from here?</i>	223
12	CONCLUSIONS, IMPLICATIONS AND FUTURE WORK	226
12.1	INTRODUCTION	227
12.1.1	<i>An educative work environment defined</i>	227
12.2	SYNTHESIS OF FINDINGS	228
12.3	IMPLICATIONS OF FINDINGS FOR THE CREATION OF EDUCATIVE WORKPLACES	236
12.3.1	<i>The role of context in workplace learning</i>	236
12.3.2	<i>The mediation of learning in organisational design</i>	245
12.3.3	<i>Cultures</i>	251
12.3.4	<i>Summary</i>	252
12.4	CONCLUSION	252
12.4.1	<i>Implications for future research</i>	253
12.4.2	<i>Epilogue</i>	255

List of Tables

TABLE 1: CONTRIBUTIONS AND PROBLEMATICS FROM THE LEARNING THEORY LITERATURE	27
TABLE 2: STRATEGIES FOR VERIFICATION IN QUALITATIVE RESEARCH	53
TABLE 3: THE RESEARCH MAP PROPOSED BY LAYDER	55
TABLE 4: PHASES OF THE RESEARCH STUDY	58
TABLE 5: SUMMARY OF DATA TRANSCRIPTION AND USE IN DATA ANALYSIS FOR THE STUDY	64
TABLE 6: STRATEGIES USED TO VERIFY THE STUDY'S AUTHENTICITY.....	67
TABLE 7: CHANGING CHARACTERISTICS OF WORK AND EXAMPLES IN ATC	80
TABLE 8: TIME FOR EACH PHASE OF OPERATIONAL TRAINING FOR EACH PATHWAY.....	84
TABLE 9: STRUCTURAL ELEMENTS INVESTIGATED IN THIS THESIS	96
TABLE 10: SUMMARY OF TIME FRAME FOR AIRSPACE SECTORS.	101
TABLE 11: ASPECTS OF WORKPLACE CULTURES IMPORTANT TO THIS THESIS.....	103
TABLE 12: SUMMARY OF WORK GROUP CULTURES EVIDENT IN THE STUDY	105
TABLE 13: THE LINKAGE BETWEEN ELEMENTS OF CONTEXT AND PROCESSES INVOLVED IN LEARNING.....	126
TABLE 14: WORK EXPERIENCE AND ITS IMPACT ON ATC WORKPLACE LEARNING	137
TABLE 15: ELEMENTS OF EXPERIENCE AND ATTRIBUTES DISPLAYED IN GOOD ATC WORK	138
TABLE 16: DIMENSIONS OF EXPERIENCE IN ATC WORK AND OPPORTUNITIES FOR REFLECTION.....	156
TABLE 17: THE MEDIATION OF OPPORTUNITIES FOR EXPERIMENTATION BY ELEMENTS OF STRUCTURE AND CULTURE.....	193
TABLE 18: PROCESSES OF EXPERIMENTATION AND INFLUENCES OF STRUCTURES AND CULTURES	193
TABLE 19: EXAMPLES OF CHANGES OCCURRING WITHIN THE ATC WORKPLACE.....	208
TABLE 20: CHANGES TO THE SOCIALITY OF ATC WORK	221
TABLE 21: INFLUENCE OF CONTEXT ON WORKPLACE LEARNING.....	239
TABLE 22: INFLUENCE OF STRUCTURAL ELEMENTS ON OPPORTUNITIES FOR INFORMAL LEARNING: FORMALISATION	246
TABLE 23: INFLUENCE OF STRUCTURAL ELEMENTS ON OPPORTUNITIES FOR INFORMAL LEARNING: DIFFERENTIATION AND INTEGRATION.....	248

List of Figures

FIGURE 1: REASON'S MODEL OF THE "ORGANISATIONAL ACCIDENT"	11
FIGURE 2: ESTIMATED AIR TRAFFIC GROWTH AND PROJECTED AVIATION ACCIDENTS.....	75
FIGURE 3: ILLUSTRATION OF AREAS OF RESPONSIBILITY FOR ATC WORK: TOWER, APPROACH, ENROUTE AND ARRIVALS.....	77
FIGURE 4: STANDARDS OF SEPARATION USED IN ATC	78
FIGURE 5: AN ILLUSTRATION OF THE LAYOUT OF A CONSOLE USED IN PROCEDURAL AIR TRAFFIC CONTROL	79
FIGURE 6: FINAL FIELD TRAINING MODEL - SOUTHERN DISTRICT OFFICE.....	85
FIGURE 7: THE TYPICAL CAREER PATH OF A CONTROLLER	86
FIGURE 8: THE TWO CENTRE CONCEPT IN OPERATION: THE AREA COVERED BY THE SOUTHERN REGION IS CONTROLLED FROM THE MELBOURNE ATC CENTRE	93
FIGURE 9: COMPONENTS OF AIRSERVICES AUSTRALIA'S ORGANISATIONAL STRUCTURE RELEVANT TO THIS THESIS	95
FIGURE 10: THE TYPE OF CONFIGURATION USED TYPICALLY IN ATC OPERATIONS	97
FIGURE 11: ORGANISATION OF WORK WITHIN THE ROOM	99
FIGURE 12: GEOGRAPHICAL OUTLINE OF ATC SECTORS, SOUTHERN DISTRICT OFFICE	100
FIGURE 13: KOLB'S MODEL AS A FRAMEWORK TO LINK ORGANISATIONAL CONTEXTS AND THE PROCESSES OF LEARNING.....	123
FIGURE 14: KOLB'S MODEL AS A FRAMEWORK FOR LINKING ASPECTS OF PSYCHOLOGICAL AND SOCIOCULTURAL THEORIES OF LEARNING	125
FIGURE 15: THE EMBEDDEDNESS OF ALL OF THE PROCESSES OF LEARNING WITHIN EXPERIENCE.	136
FIGURE 16 THE SOCIALITY OF ATC WORK	150
FIGURE 17: THE BEGINNINGS OF CIVIL AIR TRAFFIC CONTROL IN AUSTRALIA.....	207
FIGURE 18: AIR TRAFFIC CONTROL AT THE TAAATS CONSOLE	221
FIGURE 19: THE INFLUENCE OF STRUCTURES AND CULTURES ON THE PROCESSES INVOLVED IN LEARNING	231
FIGURE 20: THE CONTEXTUAL MEDIATION OF ACCREDITED ATC LEARNING.....	238

List Of Appendices

- 1 COMMENTS FROM AIRSERVICES STAFF ON THE DISSERTATION
- 2 SCHEDULE OF QUESTIONS USED IN THE SEMI-STRUCTURED INTERVIEWS
- 3 ETHICAL PROCEDURES FOLLOWED IN CONDUCTING INTERVIEWS
- 4 DESCRIPTIVE CODES USED FOR FIRST PHASE OF ANALYSIS
- 5 APPLICATION OF THE DESCRIPTIVE CODES TO AN INTERVIEW
- 6 EXAMPLE OF A DATA ATTACHED TO A NODE AND A NODE MEMO
- 7 SUMMARY OF ATC ABBREVIATIONS USED IN THE COURSE OF THEIR WORK
- 8 A TYPICAL FLIGHT
- 9 EVALUATION CHECK SHEET USED IN ASSESSING ATC COMPETENCE
- 10 GUIDELINES ASSOCIATED WITH ON-THE-JOB TRAINING
- 11 SELECTION OF WAR STORIES NARRATED BY AIR TRAFFIC CONTROLLERS

Acronyms and terms used in this Thesis

AACC	Aerodrome Area Control Centre
Abinitio	New recruit trainee
ADC	Aerodrome Departure Controller (Tower ATC position)
ADSO	Airways Data Systems Officer
ASA	AirServices Australia
ATC	Air Traffic Control
CAA	Civil Aviation Authority (predecessor to ASA)
CC	Conversion Course (training to ADSOs and FSOs)
DME	Distance Measuring Equipment (used in navigation)
EBA	Enterprise Bargaining Agreement
FAA	Federal Aviation Administration
FPC	Full Performance Controller
FSO	Flight Service Officer
GBE	Government Business Enterprise
HF	High frequency (radio)
ICAO	International Civil Aviation Organisation
OJTI	On-the-job training instructor
SMC	Surface Movement Controller (ATC Tower position)
STARS	Standard Arrival Route Sequencing
TAAATS	The Advanced Australian Air Traffic System
TOI	TAAATS Operational Instructor
UToL	University of Tasmania at Launceston

Section One

The foundations

This section sets out the theoretical and methodological background to the study. It comprises the introduction (Chapter One), the review of the literature (Chapter Two) and the Chapter outlining and discussing the method (Chapter Three). This section will set the scene by outlining the main features of the changing nature of work and work organisation and the reason why learning in workplaces is becoming increasingly important. It will then review the literatures on learning and organisational theory and then discuss the research design and methods used in validating the empirical study.

Chapter 1

Introduction

This chapter introduces the reasons why learning in the workplace is an important site for investigation. Identifying ways to support learning in the workplace is justifiable on both moral and economic grounds. The chapter outlines the changes occurring to the nature of work, including characteristics that are likely to be important in future working environments of many people. The aim of the chapter is to situate the research undertaken within a wider context of workplace change. The aims of the study, its justification as well as the structure of the rest of the Thesis are outlined.

1.1 Introduction to the study

Why study learning in workplaces? There are two reasons why the study of learning in workplaces is important. The first reason is a moral one: work is an essential part of life and has a profound educative function. It is through work that we have the possibility to commune with others and to contribute to the common good. The workplace is a site through which we learn our sense of self-worth, our values, and about who we are in relation to others. The second reason is an economic and political one: it is through learning in workplaces that organisations can respond to environments increasingly characterised by change and uncertainty. It will be argued in this Thesis that as organisations grow more complex within increasingly turbulent environments, learning in the workplace is becoming recognised as an important means to assist organisations to survive and flourish. However, as we shall see, learning in the workplace takes many forms.

Learning is easily visible when it is formally organised, where it often leads to the accreditation of workplace skills, and yet it also occurs in a range of non-formal ways that are not so easily visible but are nevertheless important. This Thesis focuses on these two conceptualisations of learning in the workplace: the formally organised learning that is designed to assist the worker to acquire skills, and the informal learning that is embedded in everyday work practice as individuals, groups and organisations are involved in changing practices that change the world (Lave 1996). It will be argued that both formal and informal learning are influenced by the workplace context, defined here as the organisational structures and cultures that are inherent components of all workplace environments. In this chapter, the changing nature of work and work organisation, together with the main factors that have led to these changes, are outlined to establish the background of this study.

This chapter:

- introduces the changes occurring to the nature of work and summarises why learning in the workplace is achieving increasing attention;
- outlines how these changes have been addressed in Australia;
- situates the purpose and significance of this Thesis within the broader context of workplace learning and change; and
- outlines the structure of the chapters to follow.

1.2 The importance of work in life

Historically, work has been regarded as an honourable calling by thinkers as diverse as Rousseau, Mill, and Marx, each of whom regarded work as a central learning domain and an important sphere for the development of human capacity (Pateman 1970; Welton 1991). Work is important because it provides individuals with the opportunity to contribute to meaningful social relations

and to the common good of society. "Making a contribution to the common good is what makes us aware of our role, of our ego. Socialization takes place, in the case of an adult, most effectively through the process of contributing to the common good" (Leymann 1989, p. 284).

It is contended that the educative function of work is a neglected theme within both social and educational theory (Welton 1991). Meaningful work facilitates the growth and development of the individual because "workplace efficacy is linked to efficacy in all other areas of human activity" (Welton 1991, p. 10). For many people there is a close association between what they do every day at work and the quality of their life in general. This is because there is a close "interrelationship between the authority structure of institutions and the psychological qualities and attitudes of individuals" (Pateman 1970, p. 27). For example, authority structures in work organisations that lead individuals to undertake dull repetitive work that blocks the imagination can lead to psychological conditions of helplessness and alienation (Welton 1991). In this context, therefore, the workplace can be regarded as a cultural environment characterised by a set of transactions that lead to possibilities for enabling or constraining learning (Pipan 1989). It is contended that the constraints imposed on the creation of developmental work environments must be confronted, and the features that enhance learning identified, if organisations are to become sites for learning and development. This Thesis argues that particular concepts of learning can be applied to evaluate workplace environments to assess the extent to which they enable or constrain learning and development.

1.2.1 The rise of the "learning society"

In work organisations, it is through recognising the efficacy of working together, rather than separately, that we advance knowledge and production (Collinson 1992). Yet attention to learning in the workplace has been coming from an altogether different source than the scholars mentioned above. According to Ainley (1994, cited in Young 1995), it is not by chance that the term "learning society" is becoming increasingly used, not just by educational philosophers but also by business and management theorists as well as by governments of the political left and right. The emerging focus on learning and work has developed, Aronowitz and Giroux (1985) argue, because corporations have lost their competitive edge: "industry has rediscovered education because it has lost its once secure markets" (Aronowitz & Giroux 1985, p.9). In this context, learning in the workplace and "skilling" of the workforce are needed to assist workers within such organisations to manage in a climate of change.

In Australia learning in the workplace was identified during the 1980s as one of the key planks in industrial reform to cope with Australia's own declining economic fortunes (Dawkins 1988; Dawkins & Holding 1987; Ford 1990). Australia's export composition had been weighted towards low-value-added agricultural and mineral products, and this was contrasted with the trend in world trade towards sophisticated manufactures and services in an emerging knowledge-based economy. Education and training were identified as key planks in an industrial reform agenda aimed at halting Australia's declining economic fortunes. At the time policy documents

expounded the need for a “clever country” (Dawkins 1988, p. 5) and for a workforce that was “multi-skilled” and “flexible” (National Board of Employment, Education and Training [NBEET] 1989). Subsequent changes throughout the late 1980s and early 1990s involved policies aimed at upgrading technology, restructuring employment awards to increase job flexibility and restructuring work organisation (Australian Council of Trade Unions/ Trade Development Commission [ACTU/TDC] 1987). These included three complementary strategies:

- Technological improvement was emphasised to enable industries to develop and respond to a changing global work environment.
- Industrial reform aimed at restructuring industrial awards governing work. Award Restructuring acknowledged the need for people to have multiple skills and to be recognised for those skills. Changes to industrial work agreements later became known as “enterprise bargaining agreements”.
- Along with changes in work practices, new technology, new organisational structures and new ways of working, came an enormous demand for training. Within Australia, this became known as “the training reform agenda”.

These policies have also had their critics. Marginson (1990, 1992), for example, has argued that skills alone are not sufficient to improve Australia’s economic fortunes. How those skills are organised and utilised are key factors in organisational success (see also Karpin 1995; Mansfield 1993). Within the Training Reform Agenda, attention has been given to different forms of training delivery (e.g., Ashworth & Saxton 1990; Hager 1993; Hyland 1992; Jackson 1993) and more recently, to learning in the workplace (Billett 1998; Hager 1997; Hall 1996; Sefton, Waterhouse & Cooney 1995; Stevenson 1995). These policies are important because, it is argued later in this Thesis, their implementation has had a direct and profound impact on the work practices of many Australian workers. It is shown later in this Thesis that within the workplace under study, these initiatives have both enabled and constrained opportunities for learning in the workplace.

What are the bases for the changes that lead to organisations and national governments attending to learning as a key strategy for economic reform? Addressing this question requires an examination of developments in technologies and communications, globalisation and internal work organisation - forerunners to the rise in popularity of learning as an economic and political strategy of workplace change.

1.3 The changing shape of work environments

Changes in technology, the globalisation of markets and rapid market shifts have together resulted in an increasing pace of change in organisations and these, in turn, have led many organisations to change the way work is undertaken. The background to these changes will now

be outlined so that the focus of this Thesis can be situated within the broader changing shape of work environments.

1.3.1 Technological change and its impact on work

Technological development has brought about changes in both skill demands and the nature of work, though the direction of such change has been debated for many decades. Optimistic views of technological change have postulated that the evolving economy would require ever-increasing skills because the era of the post-industrial society would leave no room for manual and unskilled labour (Bell 1974); whereas pessimistic views have contended that technology was being used to reduce the skills needed by production workers, widely referred to as “deskilling” (Braverman 1974). Still others even question the role work plays in determining a person’s identity (Offe 1985).

1.3.1.1 Contesting the impact of technology

The impact of technology on the future of work continues to be contested. Bailey (1990), for example, in researching changes in the nature of work in the manufacturing and service industries, did not find “a proliferation of powerless low-skilled workers” (p. 14), but instead found demand for increasing skills. This has been supported by some researchers (e.g., Berryman 1993; Crean 1997; Jones 1997), and contested by others (e.g., Beynon 1997; Gee, Hull & Lankshear 1996; Hull 1997). The possible coexistence of the three scenarios mentioned above has been advanced by Grubb (1998). That is, there will be a trend in increasing the skills demanded of workers as a result of increasing complexity of work, a trend showing the continuation of deskilling practices, and a trend where workers cobble together fragmented careers from “contingent work” (Grubb 1998) based on temporary and contract work. This Thesis is concerned with the first trend mentioned above. That is, with the increasing demands and complexity required of people working in “high performance” workplaces (Kalleberg & Moody 1996; Smith 1997; Tomer 1995). The nature of high performance workplaces will be discussed later in the Chapter.

Technological change has directly influenced change as a result of increased telecommunications and transaction capacities, which has lead also to globalisation of markets. These changes have led to “the intensification of competition, particularly international competition; changes in the demand for goods and services; and the general increase in uncertainty and in the pace of change in technology, production processes and markets” (Bailey 1990, p. 19).

1.3.2 Globalisation

Technology has advanced communication possibilities and, in combination with economic shifts, has led to globalisation. Globalisation is a term used to describe how the organisation of production and its related activities (e.g., consumption) are organised on a global scale (Castells 1997). Such developments have influenced — and been influenced by — changes in consumer demand (Piore & Sabel 1984). Piore and Sabel (1984) contended that changes in consumer

demand have broken up mass markets, thus favouring firms who can react flexibly to market shifts. They claim that a “community of multi-skilled workers seems a precondition for agile manoeuvring in a hostile world” (Piore & Sabel 1984, p. 213). These shifts have led to standards for products and demands that have been set at an international level and for a greater demand for organisational “responsiveness” (Ford 1990). In this context, organisational restructuring was needed to create more flexible production systems in order to cope with this changing external environment. “Flexible specialisation” (Harvey 1990), where organisations could respond to niche markets quickly with “just-in-time” production methods (Mathews 1990), required different forms of work organisation.

1.3.3 Changes to the internal organisation of work

Reducing the time taken to respond to the external environment has become increasingly important as a result of changes in technology and globalisation and this has required changes in the internal organisation of work. Tall organisational hierarchies have been replaced with team-work and flatter organisational structures (Beyerlein, Johnson & Beyerlein 1997). Routinised and narrowly defined work practices have also changed (in Australia, with the assistance of the Government policies mentioned earlier) to develop a multi-skilled workforce who now engage in multiple job roles and tasks.

For organisations immersed in the contexts of change described above, education and training are policy initiatives used to support changes to work organisation, as Bailey (1990) concluded:

Firms and workers are now involved in more integrated and interdependent networks in which, in many cases, there is greater autonomy at lower levels and decentralisation of decision making. This juxtaposition of interdependence and autonomy and its attendant technological and organizational developments can potentially have a strong influence on skill needs and human resource strategies, including training provided by the firm (p. 31).

In summary, individuals and organisations have experienced change as a result of technological development, globalisation and the emergence of new economic forms based on flexibility and a knowledge-based economy. These pressures, in turn continue to lead to changes in the nature of work and the demands placed upon the workforce.

1.3.4 The rise of “knowledge work” and high-performance work

Arguments about the rise of the “knowledge worker” are well established (Castells 1997; Crean 1997; James, Veit & Wright 1997; Jones 1997; Reich 1992). For example, forty per cent of the Australian labour force are now composed of “knowledge workers” (Jones 1997). The central element of knowledge work is the “generation, manipulation, storage, retrieval and application of symbols, words, numbers, sounds, images or symbolic objects, banknotes, cheques, letters, certificates, print-outs, photographs, films, invoices” (Jones 1997, p. 260). Jones goes on to say

that these elements of information are reduced to signals which are increasingly “sent through the air or along a wire and reconstituted at the other end” (p. 260). This illustrates the growing use of computers and other forms of technological hardware that are mediating the work that people do. In the USA, Krueger (1993) found that the percentage of US workers directly using computers in their work had risen from 24.6 per cent in 1984 to 37.4 per cent in 1989. In Australia, a rate of computer usage in the workplace consistent with Krueger’s findings was identified in a study by Miller and Mulvey (1996) where, in 1995, 55.7 per cent of the workforce were involved in computer use (i.e., where work involved direct computer use). This figure might have been much higher if it also included those people in the workforce who are reliant on computers somewhere within the organisational system (e.g., scanning prices in a retail setting). These figures indicate the extent of knowledge work where information and symbols are manipulated as part of the work process and where work is either directly or indirectly mediated by a computer.

Just as work is becoming more knowledge based and computer-mediated, it is also increasing in intensity (James et al. 1997; Lipsig-Mumme 1997). This is related to increasing complexity of work, to multi-tasking and to meeting the performance benchmarks of “world’s best practice” (James et al. 1997). Work intensification is also related to the increasing integration of communication and computer technologies which is speeding up the flow of information (Berryman 1993; Crean 1997; Lipsig-Mumme 1997).

Work directly involving or reliant on information and its interpretation is reflected in projections of future employment in Australia. According to the Workforce 2005 study prepared by the Commonwealth Department of Employment, Education and Training (1995), the greatest growth in employment will be in some key service sector industries such as recreation and tourism, communication, finance and retail. These sectors, increasingly, are using computer-mediated forms of communication that operate on a global scale. In analysing figures prepared for the Workforce 2005 report, Crean (1997) noted that the more skilled such as some of the professional occupations are growing faster than other sectors. Evidence also suggests that the skill requirements, even in lower-skilled occupations, are increasing (Berryman 1993; Crean 1997).

1.3.5 The emergence of the high-technology, high-intensity, high-reliability workplace

As stated earlier in this Chapter, the focus of this Thesis is on the demands placed on people working within a particular type of “high-performance” workplace and the role learning plays within them. High rates of change are particularly evident in workplaces characterised by high-technology, high-intensity and high-reliability work. High-technology organisations are those that involve work mediated by computers and other forms of technology. High-intensity work occurs in contexts that have time pressures and sometimes a strong sense of urgency. The dynamic “real-time” nature of the work contains elements that once initiated, cannot be stopped and

must be managed as events evolve. Within such organisations, the focus is also on extremely reliable operations because an error can potentially lead to unacceptable consequences.

High-technology, high-intensity and high-reliability workplaces are generally characterised by:

- the use of complex technologies including computer-mediated communication (Reason 1993; Suchman 1996);
- information service provision including the interpretation of symbols (Reich 1992; Jones 1997);
- time pressure and a strong sense of urgency (Patel, Kaufman & Aroca 1995);
- high levels of responsibility and sometimes high risk (Maurino, Reason, Johnston & Lee 1995; Reason 1993);
- an emphasis on 100 per cent quality (Flin 1998, Flin, Salas, Strub & Martin 1998; Helmreich, Merritt & Wilhelm, 1998);
- imperfect information, uncertainty [not everything bearing on the task is known] and continuously changing conditions (Patel et al. 1995);
- higher order thinking which:- is non algorithmic (i.e., the path of action is not fully specified in advance), is complex (the total path is not mentally “visible” from any single vantage point), is effortful (often yielding multiple solutions, each with costs and benefits, rather than unique solutions) and involves nuanced judgement and interpretation, requiring the application of multiple, sometimes conflicting, criteria (Resnick 1987); and,
- multiple agents working in cooperation because the task is so complex, no one single individual is capable of undertaking the entire job (Lave 1996; Pea 1993).

In this Thesis, work found in high-technology, high-intensity, and high-reliability organisations will be described as “High-3” work. Many organisations are becoming increasingly complex in order to respond to the changing environmental conditions discussed earlier and, in so doing, are adopting many of the characteristics found in such work environments (Crean 1997; Engestrom & Middleton 1996a; Jones 1997; Mathews 1994; Reich 1992). High-3 organisations are observable in virtually all industry sectors, although the more-developed examples are to be found within transportation (e.g., air and sea), the military, police, emergency services (e.g., ambulance and firefighting), health services (e.g., operating rooms), manufacturing (e.g., chemical industries) and key elements of the finance sector (e.g., the stock exchange). Moreover, the proportion of organisations characterised by these forms of work is growing as part of the growth of a knowledge-based economy, as is our reliance on them (Crean 1997; Engestrom & Middleton 1996a).

1.3.5.1 Continuous learning and High-3 work

A substantial body of research (e.g., Engestrom & Middleton 1996a; Hirschhorn 1984; Reason 1993; Watkins & Marsick 1993; Zuboff 1988) has suggested that for the potentials of organisational and technological change to be realised, learning must become integral to the work itself. Worker actions in organisations characterised by complexity, intensification and

computer-mediated technology, take on greater import as the potential effects of an error within these systems increase in consequence and magnitude (Hirschhorn, Gilmore & Newell 1989; Perrow 1984; Waldrop 1992; Zuboff 1988). This is acknowledged as being even more important in work environments involving advanced technology since the majority of incidents and accidents are as a result of human error (Hartel & Hartel 1995; Reason 1993; Westrum 1993; Zuboff 1988). Hence, continuous learning at individual, group and organisational levels is particularly important in these work environments.

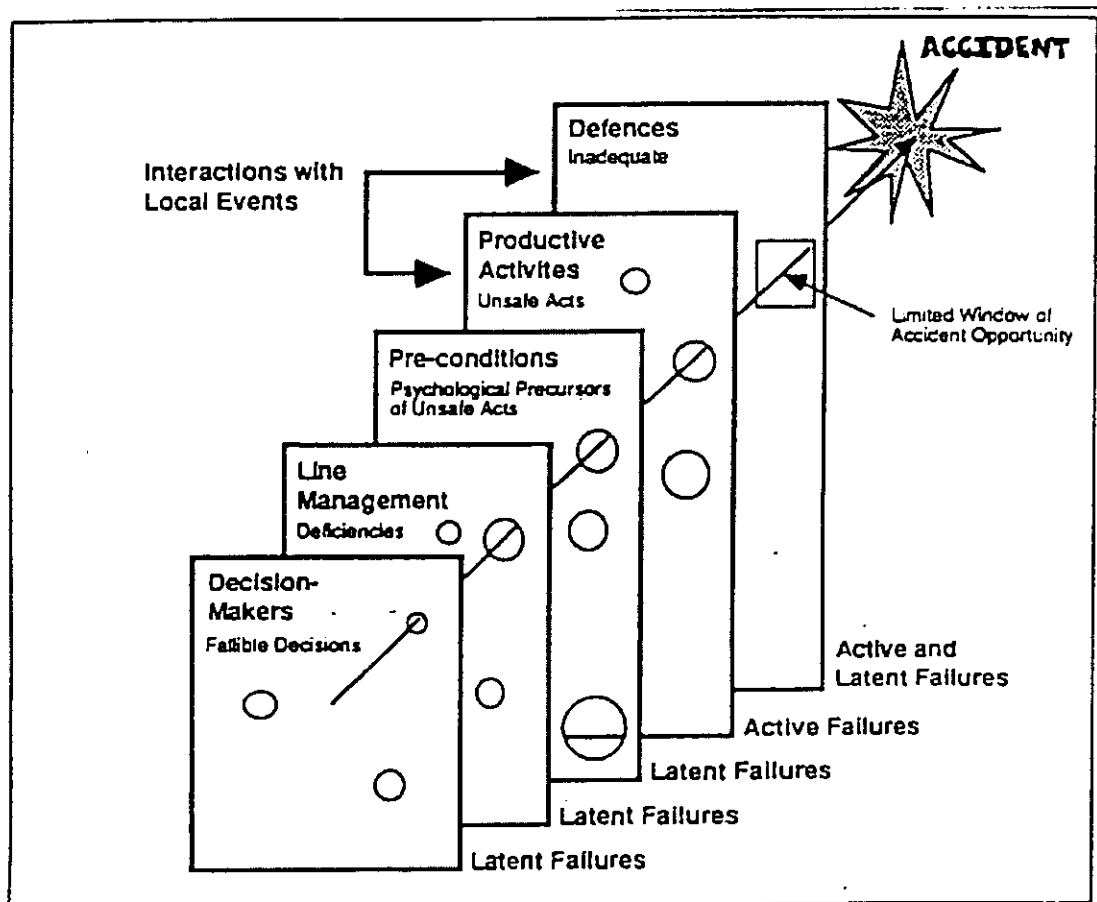
Prime examples of High-3 work are found in the aviation industry. As an example of a High-3 work environment, the aviation industry has advanced many ideas and models to assist in understanding human performance in complex systems. The aviation industry was born from the risk-taking of individuals attempting to do something previously not possible. The stereotypical images of success within the aviation industry, characterised by the aircraft pilot, "a single, stalwart individual, white scarf trailing, braving the elements in an open cockpit" (Helmreich & Foushee 1993, p. 4), have led to acceptance - indeed celebration - of norms associated with "independence, machismo, bravery, and calmness under stress" (Helmreich & Foushee 1993, p.4). The history of these experiences led to assumptions that successful performance depended on individual activity and not team effort, even when it can be determined that success was based on team-work (ICAO, 1994). In the aviation industry, this view began to change over time when investigations into jet aircraft accidents began drawing conclusions that "pilot error" was more likely to reflect failures in team communication and coordination than deficiencies in an individual's technical skills (Murphy 1980). The awareness of the importance of team-work and interpersonal communication has continued. In investigating incidents and accidents in the US, Sherman and Helmreich (1993), concluded that the most common reasons for communication failures were not because of the unavailability of needed information, but rather because (1) the person who had the information did not think it necessary to transfer it, or (2) the information was transferred incorrectly (Hartel & Hartel 1995). These investigations have also extended beyond examination of air-crew dynamics, where most of the research in this field has been conducted, to include other actors in the aviation system (e.g., maintenance crews, air traffic controllers - see for example Endsley 1998), although there is a paucity of research in this area.

A further change occurred also when more attention was given to the role of context in mistakes made in High-3 work environments. The role of organisational elements in High-3 work was given prominence in 1987, in the maritime world, with Mr Justice Sheen's assessment of the causes of the capsizing of the "Herald of Free Enterprise". After acknowledging the errors of the crew, he went on to say that the causes of the disaster lay higher up the organisational hierarchy, where a culture of "sloppiness" appeared evident (Sheen 1987). In the aviation industry, Commissioner Moshansky's (1992) inquiry into the crash at Dryden, Ontario produced a similar judgement and signalled the recognition of the role of organisational structures in the analysis of accidents. When introducing his findings, Commission Moshansky wrote

The accident at Dryden.... was not the result of one cause but a combination of several related factors. Had the system operated effectively, each of the factors might have been identified and corrected before it took on significance. It will be shown that this accident was the result of a failure in the air transportation system. (Moshansky 1992, in Maurino et al. 1995, p. 2)

Over the past decade numerous models have been developed to assist in understanding the role of organisational context on individual or group error in High-3 work environments. Reason (1990), for example, has produced one of the most widely cited examples and his model is presented in Figure 1. According to Reason (1990) High-3 organisations have in place a series of layers or shields to ensure a mistake does not happen. An accident occurs when those organisational “defences” fail (see Figure 1). Organisational defences include decisions made about technologies, training, procedures as well as unsafe acts performed by those directly involved in the work activity. Accidents occur when “holes” in the layers line up to create a

Figure 1: Reason’s Model of the “organisational accident”



window of opportunity for an error to occur. Reason (1990) further theorises about these layers in terms of whether they are latent or active. The system's deficiencies are present but latent. If the system's defences work, a benign incident occurs. If they fail, and line up with active errors, then an accident results. In this Thesis, these layers or shields are discussed as organisational structures and cultures. These kinds of models are helpful to this Thesis because they draw attention to processes of organisation and how they influence the potential for an organisational accident to occur (that is, a mistake where organisational contexts are implicated in the error as well as human performance). This model suggests that people at the "sharp end" of the aviation industry (the flight crew, maintenance engineers, air traffic controllers etc) are the inheritors of many systemic errors and thus are not solely responsible (Reason 1993).

Within ATC work in particular, the pace of change has been dramatic. Technological developments have resulted in a decreased need for direct communication between ground control and air-crews, and a centralisation of services. Organisational changes include the introduction of teams, and the implementation of industrial reform aimed at enhancing flexibility and multi-tasking. Increases in workload and complexity now place even greater demands on air traffic controllers, requiring more emphasis on workload management and team skills (ICAO 1994). As the air traffic management system becomes more complex, particularly with the introduction of "intelligent" technologies, it becomes imperative to understand the ways in which individuals collaboratively engage in continuous inquiry within and between their respective teams; and how those individuals inquire and learn from each other such that the performance of the individual, team and organisation is enhanced. Although High-3 organisations, such as ATC, have policies and procedures in place to reduce communication errors - such as standardised communication procedures built into checklists and Standard Operating Procedures, and highly routinised discourse between agents - these procedures sometimes do not work. One of the central elements of this Thesis is the identification of those communicative processes that are needed to supplement existing organisational processes. Enhancing communication processes is important also given the pivotal role air traffic plays in Australia's current and future economic and social well-being and will be discussed further in Chapter Four.

Therefore, within High-3 work environments, and within the aviation industry in particular, increasing attention has been given to the role of context in human performance and to the importance of interpersonal communication within work groups. This has led some experts working within the High-3 field to examine closely the flow of information within organisations (Westrum 1993, 1995, 1998a, 1998b) and to advocate for the creation of "generative" organisations where people can think and communicate effectively (this requires both appropriate organisational structures and cultures). Westrum (1992) proposed that what was needed in organisations was the development of "requisite variety" through a culture of continuous inquiry. The skills of conscious inquiry include many behaviours that an educationalist would regard as learning-related such as: being able to ask the right questions,

sharing observations, seeking alternative perspectives, assertively challenging a particular opinion, seeking clarification, sharing information and consulting and collaborating. Requisite variety is then enabled because such learning-related behaviours make possible the expansion of the number and variety of experiences, and this increases the number of possible options that might be available. Interest continues to grow in the role of context in human performance in High-3 work environments (e.g., Reason 1998, Satchell 1998), together with a focus on the role of the group and culture (e.g., Endsley 1998; Helmreich & Merritt 1998; Helmreich, Merritt & Wilhelm 1998) and on enhancing processes of continuous inquiry (e.g., Westrum 1993, 1997, 1998a, 1998b), in this Thesis, practices associated with learning.

1.4 Conceptualising learning in the workplace

In this Thesis the focus is on learning in workplaces and workplaces are sites within organisations. An organisation has been defined as “a group of people, working toward objectives, which develops and maintains relatively stable and predictable behaviour patterns, even though the individuals in the organisation may change” (Tosi, Rizzo & Carroll 1995, p. 34). A workplace organisation is one where the dominant structuring purpose of the organisation is the production of goods for either revenue generation, service provision or both (Bagnall 1996). The goods produced by an organisation may be any valued entity, for example a saleable commodity or a service. Work then, is a structured experience directed toward the provision of the goods provided by the organisation.

The empirical study of learning in the workplace is a relatively recent phenomenon. As discussed earlier, there are two goals of learning in the workplace that are of interest in this Thesis: formal and informal learning. Typically, the term “learning in the workplace” is associated with the former. That is, with training for a particular event, task or role - forms of learning that have a specific end-point (Owen 1996a). The policy directions for “Skilling Australia”, outlined earlier, support this approach. As can be seen from the brief portrait of High-3 work, however, where a culture of “conscious inquiry” is imperative, conceptualising workplace learning in this way only is unduly limiting. Attention needs to be given also to the ways in which informal learning in the workplace (e.g., Boud & Miller 1996; Garrick 1998; Marsick & Watkins 1990) can be enhanced as a continuous process.

These two ways of thinking about learning in the workplace (as a formalised process aimed at a finite end point and as an informal process embedded within work activity) are supported by two different theoretical positions within learning theory. Whereas formalised learning aimed at individual skill acquisition and the development of expertise has a strong theoretical basis in the field of psychology, the conceptual focus for the notion of learning as an informal process embedded within all forms of work activity is supported by a sociocultural perspective. It will be argued in this Thesis that neither account can fully explain learning in the workplace, although both have much to contribute to its understanding. The psychological perspective on learning

provides a strong theoretical foundation but it cannot account fully for learning in a workplace because it ignores the role of context in learning. This oversight is a frequent criticism levelled at psychological learning theories (e.g., Bredo 1994; Lave 1996). For example, in arguing that too much past research into learning and associated theory development has been limited to investigations conducted under laboratory conditions, Patel et al. (1995), have called for future theories to develop accounts of learning in dynamic real world environments, where work is characterised by time pressure, a strong sense of urgency, high risk, multiple agents, imperfect information and continuously changing conditions (i.e., the conditions found in High-3 work). Studies need to examine, therefore, learning as it occurs in a workplace context.

Theorists working from sociocultural perspective attend to issues of context, though as we shall see, not all of these theorists define “context” in the same way. A sociocultural perspective provides valuable insights to begin addressing the challenge put forward by Patel et al. (1995), because for theorists of sociocultural activity, persons acting and the social world cannot be separated. However, the meaning of learning to researchers of situated activity differs in significant ways from conventional views of learning. In traditional psychological learning theory, learning occurs as individual skill acquisition resulting in a change in cognition and behaviour. From a situated perspective, these traditional psychological notions are put in a new light. Learning and expertise are not regarded as things that occur solely inside an individual mind as traditional psychological theories would suggest (e.g., Chi, Glaser & Farr 1988), but rather, they emerge as one proceeds through a task in collaboration with others and involve the use of artefacts (i.e., tools as resources such as technologies or procedures). Therefore, the role of context is embedded in the process of learning and activity, meaning that learning *always* occurs in a context and cannot be separated from it. While this view is compelling and has much to offer, its weakness is that it often overlooks the role of individual cognition, which is still important in any work activity involving decision making, deliberation and planning. (Patel et al. 1995). Therefore, a more satisfactory way of conceptualising learning in the workplace is needed that integrates key elements from psychological learning theories with a sociocultural perspective so that the issue of context can be more appropriately addressed. This is the focus of this Thesis.

1.4.1 The “problem” of context

Contexts are important in workplaces because they provide ways of integrating work and learning within environments where work is practised under dynamic and changing conditions. As will be argued in Chapter Two, traditional psychological approaches treated “context” as something of an “omnibus category that allowed the analyst to point to factors outside of the psychological task itself as contributors to performance” (Cole, Engestrom & Vasquez 1997, p. 5). However, this view is inadequate because it treats context as a preset environment that influences behaviour, rather than as a set of resources people use as they create cognition and culture in ways that are constantly shifting and dynamic (Cole, Engestrom & Vasquez 1997).

However, theorists emphasising context have not conceptualised it in a uniform way. Within sociocultural perspectives, two broad approaches to the notion of context can be identified: first, those who view context as something occurring directly (and only) within an interactional setting, and second, those who view context as including interaction as well as the influence of broader institutional structures and social forces within a history of activity. The first approach is based on a phenomenological tradition (e.g., Garfinkel 1986) where context is identified in the situations people construct for themselves. From this perspective, it is the meanings participants give to contexts, and their relationship to action that are important. Contexts, therefore, are found in the language of participants and their ongoing social interaction. An example of this perspective is found in Mehan (1996) who contended that:

the stable features of social institutions... are both generated in and revealed by the language of the institution's participants ... People's everyday practices are examined for the way in which they exhibit - indeed generate - the social structures of the relevant domain ... Inferences about social structure are permissible only when the workings of the structure can be located in people's interaction (pp. 243-244).

Although this view is attractive, it is inadequate because it ignores the influence of socio-economic structures that individuals may not be aware of but that, nevertheless, influence their daily lives. The phenomenological perspective makes contexts look like "something that can simply be created at will by two or more persons in interaction, as if independently" (Engestrom 1996b, p. 66). In contrast, an approach that attends both to individual action as it occurs within an immediate situation, as well as to broader societal forces, is that of "activity theory" (e.g., Engestrom 1995, 1996a, 1996b; Martin & Scribner 1991; Scribner & Beach 1993). In activity theory, the analysis of context is found within a history of practice and in emerging contradictions that characterise changing social relationships and persons acting within institutions. Meaning is not simply created through the interactions of co-participants but is also found in the relations between persons acting in objective social structures. According to Cole, Engestrom and Vasquez, (1997) activity theory is based on the notion of "activity systems" and these:

activity systems contain a variety of different viewpoints or "voices" as well as layers of historically accumulated artifacts, rules, and patterns of division of labor. This multivoiced and multilayered nature of activity systems is both a resource for collective achievement and a source of compartmentalization and conflict. Contradictions are the engine of change and development in an activity system as well as a source of conflict and stress (p. 4).

According to activity theory broader (humanly created) social systems, comprised of artefacts, institutional rules and divisions of labour and historical communities of practice, mediate between the individual and the social. In this Thesis, the approach taken within activity theory to

the notion of context is regarded as more satisfying. It will be argued that there are influences evident in work practice that can be traced back to broader social forces (e.g., the Australian Government's policies of industrial reform mentioned earlier) and that these influences may not be directly observable in participants' interaction. However, the meaning participants generate in relation to their immediate environment is also important.

This Thesis will argue that ways of operationalising contexts (as present in the institutional structures that influence everyday action and in the meaning participants give to their interaction) have, in organisational theory terms, most commonly been conceptualised in terms of organisational structures and cultures. An organisation's structure is based on a formal system of interlocking roles and relationships between roles, and can be seen in "forms of division of labour, departments, hierarchy, policies and rules, and coordination and control mechanisms" (Tosi et al. 1995, p. 34). An organisation's structure is also evident in the external relationships between the organisation and its environment. In addition to the formal systems, every organisation has a set of interrelated informal systems that influence behaviour. These are described as organisational culture or sometimes as "communities of practice" (Hendry 1996). Organisational culture is a set of understandings shared by a group of people that are largely tacit among members. Values, beliefs, attitudes and norms are used by members to justify certain decisions and behaviour. In practice, both structures and cultures are interwoven. Therefore, learning in the workplace is embedded within structures and cultures of the organisation.

In summary, all individuals, groups and organisations operate in dynamic environments influenced by contexts (defined in this Thesis as structures and cultures). The influence of these elements on the practice of learning is the focus of this Thesis.

1.4.2 Defining learning in the workplace

A broad definition of learning is needed, therefore, to examine the influence of contexts on (i) individual learning occurring in skill acquisition and (ii) the activity of learning embedded within work activity in the workplace. For the purposes of this Thesis, *learning* is defined as the process involving the transformation of experience through reflection, conceptualisation and experimentation which leads to an increased capacity, in individuals, groups and organisational systems, to act in the environment (after Kolb 1984). As such, learning has the following features: It:

1. is actively constructed by individuals and groups, based on their interpretation of their experiences in relation to their histories and the relationships between them and the social world (e.g., Putnam & Borko 1997).
2. is both a process and a product of the interactions we have with others (e.g., Resnick, Levine & Teasley 1993).

3. is embedded in contexts which are socially and historically constituted and are linked to broader societal structures and systems (e.g., Engestrom 1995; 1996a).
4. is often mediated by artefacts (i.e., by technologies such as computers, tools and resources). As such, learning is distributed across individuals, other persons and the physical environment (e.g., Salomon 1993).
5. is sometimes contested. Learning, particularly in organisations, involves people “whose social locations, interests, reasons, and subjective possibilities are different, and who improvise struggles in situated ways with each other” (Lave 1996, p. 17).
6. has an affective dimension, because it involves the active engagement of the self - the learner. The affective dimension of learning often arises from discrepancies between knowing and experience, which in turn generates dissonance (Brookfield 1990).
7. is a matter of degree. It can be reproductive (of past practices, beliefs or attitudes), adaptive (that is, incremental adjustment) or it can be transformative (leading to the creation of new knowledge and a reconceptualisation of understanding and changed action) (Argyris & Schon 1978; Mezirow 1991).

As discussed, in a workplace context, learning can occur formally, as part of a structured training or educational program and it can also occur informally. Learning is also embedded within work activity and organisational systems. It will be argued in Chapter Two, that the investigation of learning in the workplace has been almost universally limited to investigating formalised learning leading, that is learning that assumes a finite end point (such as the acquisition of a skill). This is particularly so in Government-sponsored Australian workplace research due to the policy goals established by the Australian Government, associated with the national training reform agenda. The investigation of learning as an ongoing component of work practice, and how this can be enhanced, has largely been overlooked. This Thesis aims to address this oversight by attending to the ways in which elements of organisational context (identified as structure and culture) enable and constrain both accredited and informal workplace learning processes.

Accredited learning is the term used in this Thesis to define formally organised learning aimed at acquiring specific knowledge, attitudes and skills. This kind of learning can occur as part of formal on-the-job instruction taking place in a human resource department, in a workplace training facility or on-the-job. It can be directed by a trainer, an educator, a co-worker or it can be self-directed. The formalised arrangements used in workplaces to facilitate accredited learning are referred to in this Thesis as *training*. *Informal workplace learning* is the term used in this Thesis to describe all other forms of learning arising when individuals and groups engage in strategies to transform the experience of work into learning. *Continuous learning* occurs when individuals and groups (and through them, organisational systems) are involved in deliberate and constant

processes of reflection and conceptualisation on experience to generate alternatives through experimentation that can lead to action and where these processes are embedded within work activity. Behaviours associated with continuous learning include those associated with what Westrum (1993) terms “conscious inquiry”, such as sharing observations, asking questions, seeking feedback and pooling alternative suggestions. Continuous learning is important in industries undergoing change and particularly in those workplaces characterised by high-performance work.

1.5 Focus of the Study

To make a contribution to the growing literature concerned with learning in the workplace this Thesis will present a detailed analysis of learning in one type of workplace, that is, ATC. This particular workplace was chosen because it represents numerous aspects of that being described in the literature on the changing nature of work and have been identified as growing in importance. ATC work occurs in an organisational context which has many of the features outlined earlier in this Chapter in that it has experienced change as a result of both developing technologies and globalisation; has undergone structural reform at an organisation and industry level; and has involved significant reorganisation of work within the organisation, including job redesign. This organisation (AirServices Australia) and the kind of work undertaken (ATC) provides an excellent example of changing structures and cultures and their influence on learning and performance. By closely examining learning on-the-job within ATC, the study explores the linkages between the contextual factors that enhance and inhibit opportunities for accredited, informal and continuous learning in the workplace. As a site for research, the ATC workplace provides an excellent environment for the development of theory aimed at accounting for learning in real world domains where work is characterised by time pressure, a strong sense of urgency, high risk and multiple agents (Patel et al. 1995).

1.5.1 Study aims

This study has one major aim and several minor aims. The major aim is to describe learning processes in one particular workplace and to investigate the ways in which these processes are enabled and constrained by organisational contexts (in the form of structures and cultures). Interviews have been conducted with trainees, instructors, human resource developers, team leaders, managers and other training support staff involved in both accredited learning processes and informal learning embedded within work activity. Thus, this study aims to develop a framework for understanding learning in workplaces, that extends recent efforts in two ways. First, it moves the investigation of learning in the workplace beyond formalised training programs. Second, it aims to extend understanding of what enhances and inhibits learning beyond the individual - to the analysis of the role of organisational structures and cultures in learning. This latter focus goes some way to address Layder's (1993) call for innovative research strategies that attempt to bridge some of the gaps:

between quantitative and qualitative methods, theory-building and theory-testing research, micro and macro-levels of analysis, and so on, by endeavouring to trace points of contact between them and thus helping to create a wider view of the relation between theory and research (p. 10).

It was the intention of this study to address this call by examining these micro-levels of analysis via an interpretive methodological approach using semi-structured interviews (Denzin & Lincoln 1994; Lather 1986), to attend to the features of social interaction and to also investigate the existence of structural and cultural phenomena. In this way, the study provides an explanation of the way in which social structure, culture and history interweaves with learning and working in activity.

A second aim was to consider the changing nature of work within one workplace and the impact this will have for learning in the future. As will be argued in Chapter Four, the organisation chosen (AirServices Australia) and the type of work selected (ATC) provide an example of changes that have been occurring in Australia over the past decade. It also provides an example of how changes such as globalisation are strongly influencing the nature of the work. Within this organisation, technological and organisational reform is leading to changes in work practice and to changes in relationships between workers. The changes evident in this particular workplace are indicative of the changes that are occurring in many industries (e.g., communication, health, finance) employing “post-industrial” technology (Hirschhorn et al. 1989).

A third aim was to work collaboratively with training personnel within the workplace to facilitate conditions to enhance learning. With these aims in mind, the following research questions guided the study.

1.5.2 Research questions

The overall question this Thesis aims to address is: “in what ways do structures and cultures enhance and inhibit learning in the workplace?” The following research sub-questions are addressed in this study.

- What structures and cultures can be identified within the workplace studied?
- In what ways do organisational structures and cultures enhance and inhibit learning in the workplace?
- In what ways do organisational changes, such as the introduction of complex technology, influence workplace learning?
- How might workplaces be designed to create possibilities for practices of continuous learning and the development of educative work environments?

1.5.3 Importance of the study

This study is significant in a number of ways. First, it makes a contribution to what is a very recent development in the literature, that is, the study of work-based learning. Despite the interest in workplace learning and the changes that have been occurring for over a decade in Australia, commentators had noted the limited amount of empirical research that had been conducted in this area (Marginson 1993a, 1993b; Walker 1993). Indeed, when this study first commenced, it had been argued that, in terms of the debates about workplace and training reform, educators had been identified by their silence (e.g., Ford 1990; Jackson 1993; Stevenson 1993). Research undertaken, in the 1980s and early 1990s was focused on the economics of training and implications for policy (e.g., Australian Bureau of Statistics 1994; Marginson 1993b; Training Costs Review Committee 1990). Throughout the 1990s the focus has been on accredited learning in the form of training programs (e.g., Ainley & Fleming 1997; Baxter 1997; Sefton et al. 1995) rather than on identifying processes of continuous learning and how these might be embedded within everyday work activity. This study extends this recent research because it moves beyond investigating formal training programs and on-the-job accredited learning to an exploration of informal learning and the influence of context on both accredited and informal workplace learning.

Second, within the emerging literature on work-based learning, this study seeks to extend understanding by attempting to integrate concepts from psychological approaches to learning with situated understandings of the importance of contextual influences found in cultures and communities of practice, and linking this understanding to accounts of the influence of structural features of work organisation on learning. From this perspective, it aims to integrate ideas from two sources within learning theory (the psychological and the sociocultural perspectives) as well as providing a bridge between learning and organisational theory.

Third, this study sheds light on the impact of the kinds of structural reform that have been occurring in Australia over the past decade and the impacts of those reforms on working people. Technological and organisational reform is leading to changes in work practice and to changes in relationships between workers within the organisation and these have implications for anyone wishing to understand the dynamics of organisational life. As such, the study provides insights into many of the changes that are occurring in the nature of work.

Finally, this conceptualisation of learning and change within the ATC is unique because it is the first time attention has been given to investigating context and learning as a key factor in linking individual, group and organisational performance. Research into learning in ATC has centred largely on biological and psychological understanding of individual performance and learning and more recently on performance at a systems level. Past research has included investigations into the physical impact of the stress associated with the work (e.g., Dell'Erba, Venturi, Rizzo, Porcu & Panchera 1994) and of individual information processing approaches (e.g., Ackerman 1992; Eyring, Johnson & Francis 1993; Issac 1994; Issac & Marks 1994) and more recently, of

organisational systems supporting ATC performance (Hopkin 1995). Recently within the aviation industry, there has also been an emerging awareness of the importance of context as an influence on performance. One of the conclusions of the FAA's research into human factors and automation in ATC was that "there is a lack of research data that would permit identification of the specific mechanisms by which formal and informal organizational contexts within the FAA interact and how they affect organisational climate and controller performance" (Wickens, Mavor and McGee 1997, p. 7). Moreover, new methodologies have also been called for to better understand performance in ATC. For example, a recent report by the European Organisation for the Safety of Air Navigation (1996, p. 12) recommended greater use of qualitative research processes in aviation psychology for exploring job tasks in ATC. The strength of the current study is that it addresses these calls by using a qualitative research design to enhance understanding about the role of context on learning and performance in ATC.

1.5.4 Summary of the process of the research

As will be discussed in Chapter Three, a range of different data collection techniques was used in the study. These included observations, interviews and document analysis. Observations and interviews were conducted with people in three operational ATC centres (Melbourne, Brisbane and Perth) as well as with head office staff in Canberra and staff in the Training College for air traffic controllers. This resulted in 100 interviews being undertaken with college instructors, training annexe instructors, on-the-job training instructors, team leaders, trainees, human resource development personnel and managers. Observations and interviews were also conducted across the three main operational functions of ATC (Tower, Approach/Departures and Enroute Control).

Data collection occurred during 1994-1996. It was possible over this period of time to interview some staff several times and to feed summaries of the data back to interested personnel to continue dialogue about the implications of the findings. In 1994, interviews were conducted with staff at the Training College for air traffic controllers and with a small number of staff working as managers, staff working in training annexes of Melbourne and Perth, team leaders and on-the-job-training instructors. During 1995, the author participated in a European tour to consider new technologies and their impact on future ATC operations. The empirical research on which this Thesis is based took place in Australian ATC centres during 1995 and 1996. In 1996 follow-up to each of the Centres occurred to confirm findings identified in the earlier data and to develop a framework for considering learning in the workplace with staff. As a means of validating the findings of the study, comments on the Thesis provided by key staff is included in Appendix 1.

1.6 Organisation of the Thesis

The Thesis is divided into three broad sections. In Section One, the theoretical and methodological foundations of the study are outlined. This includes this Chapter and Chapters

Two and Three. Chapter Two reviews literature from learning and organisational theory. In terms of learning theory, it shows that there is a growing trend toward linking learning with “doing” in a range of settings including workplaces. In attempting to make sense of learning, there is an increasing importance placed on context and situation. There is a need to link what is known about learning as individual cognition with social and organisational contexts. The chapter identifies key themes important to learning in workplace contexts and, therefore, to this study. In terms of organisational theory, this chapter concludes that structures and cultures are important elements in any social context. The chapter also identifies key themes that are examined in the investigation. Chapter Three outlines the research design and describes the measures undertaken to meet criteria of reliability and validity in qualitative research.

Section Two contains Chapters Four and Five. These Chapters outline the context of the study. Given the importance of the notion of context to the Thesis, these Chapters provide a detailed discussion, first, of the environmental changes influencing the aviation industry and the organisation of ATC work (Chapter Four) and second, of the structures and cultures evident in the ATC workplace. Chapter Four provides an overview of the changes occurring in the aviation industry and of the work organisation governing ATC work. It also outlines the kind of work air traffic controllers do. It shows that ATC work has many of the features regarded as important in future work and that the organisation governing ATC work has undergone examples of many of the Changes outlined in Chapter One. Chapter Five addresses the first research question: “What structures and cultures can be identified within the workplace studied?” It illustrates how ATC work is performed and outlines some of the organisation’s structures and cultures.

Section Three contains chapters that analyse the findings and discuss the conclusions and implications. Chapter Six maps out a conceptual framework that forms the basis of the findings discussed in later chapters. It presents a model for linking elements of psychological and sociocultural learning theories to elements of organisational context and will do so by using a particular experiential learning theory as a basis for the framework. Chapters Seven through to Ten address the research question: “In what ways do organisational structures and cultures enhance and inhibit learning in the workplace?” These Chapters each address one aspect of the experiential theory of learning used as a framework. These aspects represent four moments regarded as important in learning: experiencing, reflecting, conceptualising, and experimenting. Each Chapter considers the ways in which organisational structures and cultures enable or constrain the particular aspect of learning discussed and will draw on examples from both accredited and informal learning. Chapter Eleven considers the research question: “In what ways do organisational changes, such as the introduction of complex technology, influence workplace learning?” The chapter evaluates the ways in which the changes discussed enhance or inhibit learning in the workplace. Chapter Twelve addresses the final research question: “How might workplaces be designed to create possibilities for the development of educative work environments?” Recommendations for both organisational designers and facilitators of workplace learning are offered. The Chapter concludes the Thesis by discussing the implications

for workplace learning of changing organisational structures and cultures and suggests directions for future research.

1.7 Conclusion

This chapter has introduced the influences leading to changes in the nature of work. Improvements in technologies have led to increased opportunities and speed of communication across nations. Economies are shifting toward knowledge work. These shifts are also creating demands for faster service provision which in turn lead to an intensification of work. These global shifts are evident in Australia's pattern of employment and future projected demands on the workforce.

This study investigates learning in a particular type of workplace that provides a combination of elements influencing many workplaces. It provides an excellent opportunity to explore the linkages between major changes as a result of national policy, internal workplace change, and change to work as a result of the introduction of computer-based technologies. The focus on the linkage between learning in the workplace and continuous learning integrated with work, across individuals and groups, is particularly important. This is because of the role played by work in human development, and because of the increasing emphasis on continuous improvement in production resulting in the need for cognitive skills, communication and team-work. The next Chapter will review the literature relating to learning and organisational theory that informs the study.

Chapter 2

Review of the literature

The main themes found in both learning and organisational theory that are relevant to this Thesis are reviewed in this Chapter. The Chapter commences by addressing the question: If learning is important in workplaces, what are the salient features from learning theory that can be applied to the study of workplace learning? After having reviewed the main theoretical approaches within learning theory and the empirical research into workplace learning, the Chapter then turns to how workplace contexts have been theorised within the organisational literature. This section addresses the question: If contexts matter, then what are the features of workplace contexts that can be drawn from the literature that are relevant to this Thesis? Throughout the Chapter key themes are identified that are relevant to this Thesis.

2.1 Introduction

This extended Chapter draws together ideas and themes relevant to this Thesis from a range of literature sources spanning both learning and organisational theory. The Chapter will identify key themes in the learning literature that are of relevance to this Thesis and in so doing will emphasise the significance of understanding learning as an interrelationship between individual internal cognitions and the sociocultural context. The Chapter will then explore the ways in which organisational contexts have been theorised in the organisational literature, as structures and cultures. These themes will then be used in subsequent Chapters to assist in understanding the ways in which learning occurs in the workplace under study and how such learning is mediated by structures and cultures.

The chapter concludes by examining the traditional methodological approaches that have been used to research workplaces and argues that the approaches used have left both a conceptual and a methodological gap in the study of organisations. Most organisational research has either focused on interaction at work, using ethnographies or ethnomethodological approaches, or has focused on major transformations in work organisation (e.g., flexible specialisation). This micro-macro divide has left both a conceptual and methodological gap in organisational analysis — at the intersection of these two foci. It will be argued that there is a need to find ways to integrate micro-methodologies focusing on interactions between people in organisations with macro/structural approaches that emphasise broad historical trends in the study of organisations and society.

The Chapter:

- reviews two broad conceptual orientations in learning theory and a third which attempts to draw together the salient features of the first two;
- reviews the key elements of context found within the organisational literature; and
- reviews the methodological approaches used to study workplaces.

2.1.1 Scope

The literature for this Chapter has been drawn from a variety of sources and is not limited to research and theoretical development covering the last few years. Theoretical papers and research undertaken in the 1990s are emphasised, though reference is made also to earlier works. The themes contained in this literature review have been selected from a range of disciplines because of their relevance to different aspects of this Thesis. The interdisciplinary nature of the Thesis and the inclusion of a large number of concepts have resulted those concepts not being reviewed in equal depth. Included in the review are studies that focus on various contributions from learning theory (that are not workplace based), research studies examining learning in the workplace, as well as studies that are focused on the organisational aspects of workplaces that are not explicitly focused on learning.

2.2 The learning theory literature

In this section two main conceptual perspectives found within learning theory will be reviewed. The first emphasises learning as something that occurs within the human mind, the second emphasises learning as embedded within social and cultural contexts. The arguments contained within these perspectives are important to this Thesis because they highlight key elements that will need to be accounted for in any study of workplace learning that emphasises individual learning in a sociocultural context influenced by broader social forces and structures governing work organisation. It will be contended, however, that none of these views in isolation provide an adequate framework for understanding learning in the workplace, and that an approach can be taken that blends the best elements of the perspectives. Consequently, a third perspective that attempts to blend the features of the first two will be offered. The contributions and problematics from each of the main perspectives found in the literature are presented in Table 1. The investigation of the linkages between the social and the cognitive are critical to this Thesis, though to be able to do so, the elements from each perspective will need to be first outlined.

2.2.1 Learning theories emphasising the individual

The first perspective focuses on learning as an individual process and emphasises the central aspects of the behaviour and cognition. This perspective has a long tradition within the discipline of psychology. Within psychology, the “cognitive revolution” that followed the popularity of behaviourism emphasised that human beings are active, reflective creatures trying to make sense of their world. Individual cognitive perspectives focus on the role of symbols and how the brain represents symbols in activity and in problem solving (e.g., Newell & Simon 1972).

Literature from the cognitive perspective includes substantial theoretical development which provides themes that are important to this Thesis. Attention within cognitive psychology has been given to what has been called a symbolic or information-processing approach to learning which has focused on how people use symbols in activity and problem solving and how they abstract mental models that can be generalised to other problems. The theoretical development of most relevance to this Thesis has been the work undertaken examining skill acquisition and the development of expertise (e.g., Chi et al. 1988).

Table 1: Contributions and problematics from the learning theory literature

LEARNING THEORY	AUTHORS (E.G.)	CONTRIBUTIONS/ EMPHASISES	PROBLEMATICS
Theories focusing on the individual	Bandura 1997; Benner et al. 1996; Chi et al. 1988; Fiske & Taylor 1991; Posner 1988	<ul style="list-style-type: none"> • Role of mastery and access to expertise • Dev'l. nature of skill • appropriate motivational context • Role of experience • Constructivism 	<ul style="list-style-type: none"> • Over-emphasis on individuality • Under-emphasises the relative importance of groups and context, including structures and cultures
Theories focusing on the sociocultural context Social Cognition, Situated activity, Distributed cognition Activity theory	Brown, Collins & Duguid 1989; Greeno & Moore 1993; Lave 1996; Lave & Wenger 1991; Pea 1993; Suchman 1987	<ul style="list-style-type: none"> • Interactive link between context and activity • Importance of cultures and communities of practice • Role of distributed artefacts in knowing 	<ul style="list-style-type: none"> • Overlooks role of individual and cognition • Does not detail processes involved in learning, • Ways in which contexts enable and constrain not clearly delineated
Theories that contain elements of the above perspectives Constructivism Activity theory	Engestrom 1994, 1995, 1996a; Putnam & Borko 1997; Resnick 1987, 1993	<ul style="list-style-type: none"> • Linkages between individual and collective schemas • Importance of history, multi-voicedness and contradictions 	<ul style="list-style-type: none"> • Identifies elements that enable and constrain learning but does not systematically address how they can be changed

2.2.1.1 Skill acquisition and the development of expertise

The nature of the development of a well structured knowledge base has been the focus of research into expertise (Chi et al. 1988). In their research they conclude that experts:

1. excel mainly in their own domains;
2. perceive large meaningful patterns in their domain;
3. are fast. They are faster than novices at performing the skills of their domain, and they quickly solve problems with little error;
4. have superior short-term and long term memory. This is not because their memory is larger than that of others, but the automaticity of many of their skills, frees up resources for greater storage;
5. see and represent a problem in their domain at a deeper (more abstract) and/or broader (more general) level than novices. Novices tend to represent a problem at a superficial level;
6. spend a great deal of time analysing a problem qualitatively; and
7. have strong self-monitoring skills.

In Chapter Seven it will be shown that these attributes of expertise are important in ATC work. Expertise is also important in the workplace for facilitators of learning since as teachers, they need not just a strong knowledge base about job content, but also a strong knowledge base about how the job is learned. Expert teachers, for example, have elaborate systems of knowledge for understanding problems in teaching (Berliner & Calfee 1996; Biggs & Moore 1994; Shulman 1987, 1990). They understand their content matter as well as the thinking of their students and with this knowledge they can create new examples and explanations when their students are confused. It will be shown in Chapter Eleven that changes in organisational structures have reduced opportunities for controllers to build up both their knowledge bases for job content and for instruction.

Expertise is predicated on a highly developed knowledge base as well as highly automated skills that are developed over years of practice. This highlights the importance of the developmental nature of skill acquisition and the role of experience. In studying the development of expertise in nursing, for example, Benner, Tanner & Chesla (1996) identified five stages of skill acquisition: (i) the novice or beginner, for whom performance is typically rule governed; (ii) the "advanced beginner" who can identify recurring meaningful situational components, (iii) the "competent" who can begin to see their actions as part of a long-range goal or plan to address the problem; (iv) the "proficient" who perceives situations as wholes; and (v) the "expert" nurse who operates from a deep understanding of the total situation and their responses become automatic. The strength of this research is that it shows the various stages of growth within the developmental stages of expertise, between being a novice and becoming an expert. It also highlights the difficulty of capturing descriptions of expert performance because the expert is no longer aware of the rules, maxims, strategies he or she is calling upon to guide expert performance (Benner et al. 1996) because they perform automatically. The weakness of such models, however, is that they present the novice-expert continuum as unproblematic: as if all that is needed is sufficient exposure to the situations and the guidance of a more knowledgeable other, thus ignoring the role of context. It will be shown in Chapter Nine, for example, how cultures mediate the guidance provided by a knowledgeable other.

Notions of expertise are also predicated on having an appropriate motivational context, necessary for experts to gain experience which enables them to keep at practice over long periods of time and thus to build up rich memory structures. Workplaces provide a strong motivational basis to learning, given the direct application of tasks and linkage to employment. However, most theories of motivation point to the need for the learner to reasonably expect to succeed since expectations of success and failure depend critically on what learners are most likely to attribute to their success and failure (Biggs & Moore 1994). Learners need an "internal locus of control" (Rotter 1966, in Fiske & Taylor 1991) when attributing their success and failure, rather than feeling that they are "pawns" with someone or something else in control of their learning and thus their destiny. This requires a sense of self-efficacy (Bandura 1997), where

individuals believe they are capable of managing prospective situations and to execute appropriate courses of action.

Self-efficacy beliefs concern one's ability to perform a particular outcome. Theories of self-efficacy (Bandura 1997; Fiske & Taylor 1991) postulate that the stronger one's self-efficacy, the more one will persist at a task. Fiske & Taylor (1991) concluded that when faced with a challenging task, the individual who believes he/she has the capabilities to perform the task effectively will be more likely to undertake it and persist at the task, than will be the individual who has doubts about their ability to perform it successfully.

These individual characteristics (appropriate motivational context, internal locus of control and sense of self-efficacy) are important also for workplace learning instructors because such efficacy is also found in the conceptions both learners and teachers hold about the nature of the job and how it is learned (see Biggs & Moore 1994 and Putnam & Borko 1997, for a review of this literature). This is important in this Thesis since it will be argued in Chapters Eight and Nine that individual and collectively held beliefs about the job and its learning mediate both learner and instructor motivation and the strategies used to achieve success. Skill acquisition and expertise are gained, in part, through experience. Some theorists have focused on the role of experience in learning.

2.2.1.2 Experiential learning theory

The work of a range of theorists has been important in highlighting the relevance of experiential learning theory (see for example Boud, Cohen & Walker 1993; Boud & Miller 1996; Brookfield 1987; Marsick & Watkins 1990; Mezirow 1991; Watkins 1991). Although it is acknowledged that experience does not always lead to learning (Dewey 1933, 1938), experience, it is argued, is the foundation and stimulus for learning (Boud et al. 1993), and this is especially so in workplace contexts.

One of the best known and widely cited (e.g., Dixon 1994; Jarvis 1997; Swieringa & Wierdsma 1992) experiential theories of learning is that developed by David Kolb (1984). Kolb's model provides a useful basis for considering learning in the workplace for this Thesis because it focuses attention on the importance of processes of learning (which involve experience, reflection, conceptualisation and experimentation) and because it also highlights learning as an iterative process occurring in a potentially continuous cycle or spiral. According to Kolb, the learning process involves four broad elements:

1. Concrete experience (which is followed by);
2. Observations and reflections (which leads to)
3. Formation of abstract concepts and generalisations (which leads to)
4. Testing implications of concepts in new situations, (which in turn leads to new experiences).

For effective learning to occur, learning must proceed through all four phases (Kolb 1984). Learning is limited, for example if an individual:

- engages in an experience but fails to observe the lessons to be derived from those experiences and
- formulates concepts to generalise to other settings, but fails to test their validity.

Kolb's learning framework is important to this Thesis because it focuses explicitly on the relationship between learning and experience. In this respect, Kolb's model can be described as "learning by experience" or "learning by doing" or "problem-oriented learning", all elements promoted in the contemporary workplace learning literature (e.g., Sefton et al. 1995; Sorohan 1993; Stern 1992).

2.2.2 Section summary

In summary, the strength of theories focusing on individual aspects of learning are summarised in Table 1 and includes:

- the notion of expertise and mastery (Chi et al. 1988; Posner 1988). This is important in workplaces such as the one under study, where the work involves complexity and higher order thinking.
- the developmental nature of skill acquisition (Benner et al. 1996). In workplaces such as ATC, there are many skills that need to be acquired on the job and jobs involving work complexity require attention to skill acquisition to gain expertise.
- the role of experience and memory (Biggs & Moore 1994). Workplace learning provides good opportunities for "authentic" experience of work tasks.
- the importance an appropriate motivational context, an internal locus of control and sense of self-efficacy (Bandura 1997). These elements will be important in any adult learning context, particularly workplaces.
- learning as a continuous cyclical process, and that there are explicit moments within a process that need to be attended to for effective learning to occur.

However, individualistic approaches cannot by themselves fully account for learning in workplaces. The weakness of this body of literature is that, while offering a useful explanation of individual factors important to learning, it fails to recognise the context or lived-in world where individuals learn and act. In terms of workplace learning, a number of authors (e.g., Kombluh & Greene 1989; Leymann 1989) claim that there has been an overemphasis on individuals learning in organisations and that this emphasis does little to improve the overall performance of the organisation. What is needed instead, is an emphasis on whole work units and the communicative infrastructures between individuals, work units and the organisation (Leymann 1989). That is, attention needs to be given to the organisational context and to features of the workplace environment that influence learning. The theoretical approach that emphasises the interaction between persons acting and the environment is the sociocultural perspective.

2.2.3 Sociocultural perspectives

The sociocultural perspective, in contrast with the theories emphasising the individual and mind, emphasises the social setting in which cognitive activity takes place. Resnick (1993) claimed that the social and the cognitive have been traditionally engaged only peripherally by theorists and researchers, "standing in a kind of figure-ground relationship to one another rather than truly interacting" (p. 1). Proponents of sociocultural theories attempt to address this problem by claiming that the setting is an integral part of that activity, not just the surrounding context for it (Chaiklin & Lave 1996; Lave 1993; Resnick 1993). The knowledge, attitudes, or abilities needed for a particular job then are shaped by the particular working context, and can only be understood from the perspective of individuals in the social setting. The premise on which these theories are based is that learning should be understood primarily as interactions between agents and their physical and social systems (Greeno & Moore 1993). For example, if one focuses on the practical behaviour of a system, one must observe the interactive behaviours of the whole system and environment over time. Seeing certain outcomes as direct products of an individual's plan is a great simplification because it does not make clear how planning works, adaptively or not, within a whole system of activity (Suchman 1987). From this perspective, "we will only come to understand shared cognition if we focus simultaneously on the individual processes that are engaged in the social setting" (Resnick 1993, p. 15). Some sociocultural theorists go so far as to suggest that there is no such thing as individual learning that occurs within a human mind and that learning is inseparable from change in the social relationships in which people participate. Such an argument was proposed by Lave and Wenger (1991) who stated that:

learning is a process that takes place in a participation framework, not in an individual mind. This means, among other things that it is mediated by the differences in perspectives among the coparticipants. It is the community, or at least those participating in a learning context, who "learn" under this definition. Learning is, as it were, distributed among coparticipants, not a one-person act. While the apprentice may be the one transformed most dramatically by increased participation in a productive process it is the wider process that is the crucial locus and precondition for this transformation ... The larger community of practitioners reproduces itself through the formation of apprentices, yet it would presumably be transformed as well (pp. 15-16).

Whilst this view appears at first glance to have merit, it is rejected in this Thesis because it is argued that work involving planning, deliberation and decision making do involve cognition that occurs within an individual mind (Patel et al. 1995), albeit within a sociocultural context. This also indicates the importance of the sociocultural context to this Thesis. Reviewed here are the emerging fields of practice associated with social cognition, situated activity, distributed cognition, constructivism and activity theory. These perspectives will be outlined and the potential contributions to this Thesis identified.

2.2.3.1 Social cognition

The premise underpinning the concept of “social cognition” suggests that the way we think and reason is a product of the interactions we have with others. According to this perspective, ideas or concepts are essentially cognitive tools with which we think and reason. It is through sustained interaction that individuals come to share common ways of thinking and expressing ideas. Such communities who share ways of thinking and communicating are sometimes called “discourse communities” (Putnam & Borko 1997) or “communities of practice” (Hendry 1996). Understanding a concept, then, means being able to use a concept in “discourse” with others, thus using it as a tool for individual thinking and communication with others. From this view, learning is a matter of becoming socialised into a certain way of thinking and learning how to use certain concepts, skills and procedures in discourse with others.

In a workplace context, for example, the trainee learns not just from explicit instruction, but also through observation of and interaction with more knowledgeable members of the group’s culture. In this Thesis, group culture will subsume the notion of discourse community and community of practice, as well as having other attributes (which will be discussed in detail later in the Chapter). Thus, in a workplace context, other workers who are regarded as knowledgeable play a critical role in learning, and not just the trainee’s instructor. The quality of thinking, from this perspective, is determined not by some absolute external criteria of what constitutes “good thinking”, but rather by the norms and expectations of a particular community (Putnam & Borko 1997). The forms of reasoning used as cognitive tools then include what the community or group views as important, rather than what others outside the group think ought to be the case. This idea highlights the importance of communities of practice or group culture in influencing how new ideas or change is accepted or rejected. In Chapter Eight it will be shown that what is collectively held as “good” ATC practice mediates learning-related behaviour associated with both accredited and informal learning.

2.2.3.2 Situated activity

Theories of situated activity (e.g., Suchman 1987) focus explicitly on the relationship between what the individual learns and the situations in which that knowledge is acquired and used. The essence of this perspective is that knowledge is inseparable from the contexts and activities in which it develops. At the heart of situated cognition is the issue of transfer of knowledge from one context to the next. A situated approach can be contrasted with that of the traditional approaches to learning and schooling which were based on the assumption that transfer of learning from one context to another would automatically occur (Berryman 1993). Theories of situated activity challenge this separation of what is learned from how it is learned and used (see for example Suchman 1987). The activity in which knowledge is developed and deployed, it is now argued, is not separable from or ancillary to learning and cognition (Brown, Collins & Duguid 1989). From a situated perspective, learning is thus inseparable from the occasions and activities of which it is the product.

The strength of this view is that it provides an account of how what students learn in schools often fails to transfer to real world domains (see Berryman 1993). It is also problematic, however, because it raises serious questions about the kinds of settings in which workplace learning should or can be set. Putnam and Borko (1997) ask if situating learning within practice is the only place where meaningful learning can occur? In many cases workplace settings, for example, do not exemplify the kind of practices innovative change programs are trying to promote. As will be discussed in Chapter Nine of this Thesis, there are certain norms of practice that would need to change if learning-related behaviours associated with continuous learning are to be developed.

2.2.3.3 Distributed cognition

The essence of the concept of distributed cognition is that cognition is not solely the property of the brains of individuals. It is distributed or “stretched over” (Putnam & Borko, 1997) the individual, other persons, and the physical environment. The assertion that cognition is distributed among persons acknowledges that, for many cognitively complex tasks, no one participant in the task may have the knowledge and skills to complete it individually. Support for this concept abounds in workplaces, where activities are typically collaborative rather than solo performances, and where work often involves depending upon resources beyond the individuals themselves such as physical tools and notational systems (Pea 1993). The essence of this perspective is that the use of such tools does not merely enhance cognition; in some cases they transform it (Pea 1993), such that cognitions are mediated by tools and other artefacts. Artefacts “range from notational systems [to]... machines and buildings” (Engestrom & Middleton 1996b, p. 4). That is, the use of tools can result in qualitative as well as quantitative changes in thinking. For example, the introduction of radar as a tool in aviation fundamentally transformed the way ATC was practiced. Distributed approaches to cognition provide some valuable themes to focus on in workplace learning. These include attending to the ways in which individual and group work is mediated by artefacts such as technology and the roles such artefacts play in supporting work activity (involving cognition and learning). However the distributed cognition approach has generally been applied to work practice (Salomon 1993; Hutchins & Klausen 1996) and its use in theory development for workplace learning has been under-utilised. For this Thesis, distributed cognition is important because it draws attention to the organisational context and the ways in which work activity and learning are mediated by technological artefacts. Its weakness is that it generally focuses only on artefacts-as-technologies and either ignores, or does not systematically examine, the ways in which other artefacts, such as organisational policies and procedures influence behaviour. The organisational design literature provides a useful source of information about other kinds of organisational structures that may operate as artefacts and this will be discussed in the second part of this Chapter.

The strength of sociocultural perspectives is that they shift the emphasis on learning from the individual to a more active and relational process (Bredo 1994). Their weakness is that they tend

to downplay the agency of the individual and some proponents go so far as to argue there is no such thing as individual learning (Lave 1996; Lave & Wenger 1991). The themes that are important to this Thesis are summarised in Table 1 and includes:

- the emphasis given to the dynamic and interactive link between context and activity (e.g., Suchman 1996);
- the importance of cultures and communities of practice (Putnam & Borko 1997); and
- the various ways in which information and knowledge is distributed across people, tools and systems (e.g., Hutchins & Klausen 1996).

2.2.4 Integrating cognitive and sociocultural perspectives

Although the literature is scant, there have been some attempts to directly attend to both the individual and the sociocultural context. Billett (1998), in advocating an integrated perspective, argues that combining contributions from individual and sociocultural approaches offers a complementarity which permits a far deeper understanding about the relationship between individuals' thinking and acting and the social world. A similar conclusion was reached earlier by Patel et al. (1995) who suggest that there are many insights to be gained from adopting a sociocultural framework but that attention to individual skill acquisition is still important, especially in work that requires deliberation, reflection and conceptual understanding.

The perspective known as "constructivism" also has been included within this particular part of the literature review because it attempts to integrate individual cognition with context.

Constructivism is based on the premise that a learner constructs a picture of the world and develops his or her own explanatory models of its different phenomena, sometimes called "schemas" or "mental models" (see Augoustinos & Walker 1995; Putnam & Borko 1997). Information is selected and interpreted and merged with earlier constructions (schemas or mental models). The ways in which this occurs in ATC will be the focus of Chapter Nine. Experience and existing conceptual models orientate and direct the attention, selection and interpretation of individuals and groups. New material again moulds and transforms earlier structures and experience.

The work of activity theory has been included in this section because it too draws attention to the ways in which the thinking and acting of human agents are enabled and constrained by structures and history. In summarising the main thesis of activity theory, Martin and Scribner (1991) contended that individual cognitive and motivational processes are embedded within the goals of larger activity systems. Activity systems then, mediate between the individual and the social context (Scribner & Beach 1993).

Using the entire activity system as the unit of analysis enables investigation of the relation between a person's acting and settings that include structural elements as well as attention to discourses, developed historically through cultures of practice. By highlighting the historical and contradictory elements within an activity system, the perspective enables an analysis of those contradictions to be used to trace disruptions and to point to new opportunities for

development. The emphasis on structure enables activity theorists to claim a strength that goes beyond both the individual and the sociocultural perspectives, as Engestrom (1995) contends:

Cognitivist and situated approaches share a common weakness. In both, the focus of analysis is restricted to actions, whether couched in 'tasks' or 'situations'. Both are unable to account for what makes people act and form goals in the first place, what creates the horizons for possible actions, what makes people strive for something beyond the immediately obvious goal or situation. What is excluded is objects and thus motives of activity — the long-term 'why' of actions. Without this level, theories of situated cognition run the risk of becoming merely technical models of 'how?' — more elaborate and flexible than mentalist models, but equally sterile when faced with societal change and institutional contradictions that pervade ... everyday action (Engestrom 1995, pp. 410-411).

Activity theory has been applied to organisational and institutional systems (see Engestrom 1996a, 1996b, 1997; Martin & Scribner 1991). The strength of activity theory is that it draws attention to history and change, and the influence of contradictory structures in mediating everyday work activity. Activity theory provides some useful themes for consideration in this Thesis because an adequate theory of learning in the workplace will need to account for change and contradiction.

Integrating individual and sociocultural perspectives yields some powerful tools for this Thesis. The literature reviewed here draws attention to:

- the importance of seeking ways of developing a framework to integrate both perspectives (e.g., Billett 1996; 1998; Patel et al. 1995);
- the role of the development of mental models and the importance beliefs and values (expressed and hidden) in filtering the interpretation of experience and action (e.g., Putnam & Borko 1997; Argyris 1976; Schon 1991);
- the need to look beyond the immediate situation or context to broader structures that influence work practice and in so doing, to look for tensions and contradictions that are part of individual's acting in the social world (e.g., Engestrom 1994, 1995, 1996; Martin & Scribner 1991).

The arguments raised by sociocultural theorists present a strong case for extending research investigation from focusing on the individual in isolation to investigating learning within group and social contexts. Both perspectives — the individual and the sociocultural — provide some insights and an approach that integrates these perspectives offers much promise. Individual perspectives on learning highlight the many features that are important for success (a knowledgeable other, practice, an appropriate motivational context, an understanding of cognition and the development of expertise). Its strength is its strong theoretical basis that can be used as a foundation. Its weakness is that it overlooks context. Sociocultural perspectives

draw attention to the role of the social and the situation and how learning is distributed across both people and artefacts and this is a strength. Their weakness, however, is that they tend to overlook the individual and do not tease out the role contexts play in enabling or constraining learning. However, there are still gaps in attempting to account for how learning occurs in workplaces. Moreover, there is no systematic framework provided within sociocultural perspectives as to how to systematically assess the various elements of, for example, workplace contexts. So far this review has focused on learning theory in general. Are there certain features that are unique in workplace learning that must be taken into account? The next section reviews some of the main themes identified in the workplace learning literature.

2.2.5 Empirical studies into learning in the workplace

This section will summarise the focus given in empirical research into workplaces as sites for learning and working. The studies reported in this section are derived mainly from research into workplace learning in Australia, though mention is also made of key research findings from other countries. Most of the research methods used in this literature were case studies (e.g., Groundwater-Smith, Deer, Sharp & March 1996; Retallick 1996; Stevenson 1995). This is not surprising given the naturalistic domain of the workplace. Some used questionnaire methods or in-depth interviews (Sefton et al. 1995). Most research into learning within workplaces can be characterised as middle-range (Layder 1993) in that they are confined in scope to domain-specific phenomena or task-specific performance. Examples include whether individuals within workplaces apply different knowledge structures (e.g., procedural or declarative knowledge) as they solve problems and whether such knowledge structures are generic or specific to particular workplace contexts (e.g., Middleton 1996).

Almost universally, the focus has been on the role accredited learning (as training) plays in the organisation's processes of production. For example the literature reviewed included:

- research examining curricular strategies to enhance the transfer of learning and delivery of training (Ainley & Fleming 1997; Athanasou 1996). The claim underpinning most of these studies is that instruction based within work environments provides learning opportunities that are more "robust" and "authentic" (Billett 1993) than school or other traditional educational environments.
- research examining the processes of skills assessment and skills recognition (Baxter 1997; Lilly 1995). These investigations fit within a human resource development framework, in that the results inform improved mechanisms for reward and compensation or career development packages and highlight the importance of workplace learning programs that are tied to the formal goals of the organisation that are supported by appropriate compensation structures. Emphasised also was the need for workplace assessors to have the appropriate skills and understanding of how the job is learned.
- research examining the role of accredited learning in enhancing workplace productivity (e.g., Catts 1997; Smith 1997) and its critique (Darrah 1995; Owen 1995a). These studies conclude that the link between policy reform and productivity enhancement is not direct and is mediated by a range of factors such as work organisation (e.g., job design).

In the studies reviewed, almost without exception, all were based on the assumption that workplace “learning” meant formalised accredited courses or training programs that may occur on- or off-the-job; this was also the case in any studies that investigated context - see for example Brooker & Butler (1997). Although these kinds of studies are helpful because they are informing about the nature of individual workplace learning, they do little to explain the ways in which context mediates learning, although there are some exceptions (Sefton et al. 1995; Billett 1998). Sefton, et al. (1995), for example, investigated workplace learning and its role in facilitating organisational change in four Australian companies. They concluded that an holistic analysis is important as a means of considering the workplace as a learning environment. They also highlighted the need to examine linkages between learning and change processes and workplace design. The emphasis on formalised accredited learning in workplace training programs is perhaps not surprising given the funding context in Australia which prioritises research supporting the National Training Reform Framework of accreditation and emphasises studies aimed at enhancing production and skill development.

2.2.6 Section summary

The purpose of reviewing the literature included in this section has been to establish both the theoretical background and the starting point for this Thesis. The focus of the research in this Thesis is on both accredited and informal workplace learning with the goal of making these processes of learning continuous. This Chapter commenced by reviewing two broad conceptual perspectives found within learning theory: the individualistic approach which emphasises learning as something occurring within the individual and the sociocultural perspective, which emphasises the influence of the social and the situation learners find themselves in. A conclusion reached here is that these perspectives need to be integrated. A review of the empirical research undertaken into learning in the workplace revealed that it is almost entirely focused on accredited learning and the role such learning plays within systems of production.

Although the studies reviewed here contribute to a better understanding of what factors enhance workplace learning, they also testify to the incompleteness of existing literature. What is needed is a way to understand how contexts influence individuals’ experience of both accredited and informal workplace learning. The individualistic approach has a long history and a strong theoretical base, largely within the field of psychology. However, it tends to either overlook or ignore the involvement of social context in learning. On the other hand, while sociocultural theorists emphasise the importance of what is social, situated or distributed in learning, they tend to overlook or ignore the role of the individual, and, therefore, fail to explain how learning occurs for individuals, within these social contexts. The empirical studies of learning in the workplace provide some insights about what are important features but do not provide much guidance for the investigation of ways of enhancing learning as a continuous process embedded in work activity. All of the literature reviewed fails to clearly delineate different forms of “context” and to show how contextual features interact and weave through learning and work

activity. In the next section, the ways in which context is framed within organisational theory will be reviewed so that these features of context can be evaluated for their influence on work activity.

2.3 The organisation theory literature

As outlined in Chapter One, an organisation's formal structure refers primarily to the patterns and regularities in its division of labour by task or function, its hierarchies of authority and its control mechanisms. Organisations also have informal mechanisms that pattern relationships and these are cultures. Organisational cultures are defined as the "habits, folkways and norms that shape action" (Westrum 1993, p. 401) and the "set of understandings or meanings shared by a group of people" (Louis 1986, p. 74). In practice both structures and cultures are interwoven. However, for the purposes of this Thesis and in this literature review, the elements of structure and culture will be considered separately.

2.3.1 Structure as an element of organisation

Most of the theoretical development about organisational structure has come from a management-oriented perspective — that is, where the primary concern is with identifying appropriate forms of work organisation to enhance the organisation's productivity. Historically, the major eras in management-oriented approaches to work organisation have included "Taylorism", emphasising the elimination of worker inefficiency; the human-relations movement, with its emphasis on creating better working conditions to meet human needs with the aim of improving worker efficiency (e.g., Argyris 1976); and the socio-technical school where the focus was on examining styles of work organisation (e.g., semi-autonomous work teams) and conditions of work in an effort to improve satisfaction and thus efficiency (e.g., Emery 1978). Taylorism, for example, provided early attempts to examine the structure of work organisation by detailing how the modification of rules, divisions of labour and hierarchies can enhance worker productivity. Taylorism led to a focus on work tasks and structure, and hierarchies of wage compensation. The human-relations movement and the socio-technical school will be discussed later in this review. Although a "one best way" approach to organisational structure still has currency within organisational change literature, such as for example in the "search for excellence" (Peters & Waterman 1982), in Japanese Management Techniques and quality control processes, most organisational theorists have shifted to a contingency approach (Reed 1985). Contingency theory suggests that the most appropriate set of structures and processes for an organisation will be contingent on finding the best fit with the environment. Organisational problems are characterised as a misfit between the organisation's structure and the environment within which it operates (e.g., Stace & Dunphy 1991).

In the organisational literature, three dimensions have been identified as key features of organisational structure (Hall 1991) that enable or constrain fit with the environment. First, organisations will vary in terms of their complexity, that is, the breadth of activities, job functions and the number of levels within an organisational hierarchy. Second, organisations will vary in

the degree of formalisation used to structure work activities; that is, in the use of policies, procedures and rules which constrain the choices of members in their work. Third, organisations will vary in the degree of centralisation structured within the distribution of power and authority in an organisation. Organisations are likely to be structured differently in terms of complexity, formalisation and centralisation depending on the external environment in which they operate (Hall 1991).

2.3.1.1 Organisational complexity—differentiation and integration

In dealing with complexity, organisations require various strategies of differentiation and integration (Jones 1995). Differentiation is the process by which people and resources are allocated to different roles, tasks and functions, as evidenced in the organisation's division of labour, and integration refers to the strategies used to coordinate those tasks, roles and functions (Jones 1995). Organisations have long been known to require various forms of "differentiation" in work activity to achieve their goals (Parsons 1960, in Jones 1995). The foundation of differentiation is the "job role", first coined by Lawrence and Lorsch (1969). The job role is a set of task-related behaviours required of a person in accordance with their position within the organisation. Simple organisations do not require a high degree of differentiation in the division of labour, whereas complex organisations are likely to require differentiation between many job tasks involving divisions of labour, as people specialise within particular jobs and job roles. Differentiation is organised structurally through mechanisms such as authority and control, that is, the power to make people accountable for their actions, to make decisions about resources and to coordinate work activity (Jones 1995). Child (1984) distinguished between differentiation found in an organisational hierarchy (vertical differentiation) and that found in the way in which tasks and roles are organised into sub-units, functions or departments (horizontal differentiation).

Differentiation can be contrasted with that of integration, which refers to the structures used to coordinate various tasks and functions. One of the earliest studies of integrative mechanisms and their role within organisation was that undertaken by Gailbraith (1979). Gailbraith (1979), posited that as organisations increased in complexity, they needed more and more integrating mechanisms to be effective. The integrating mechanisms examined by Gailbraith (1979) included teams, taskforces, liaison roles and departments with the responsibility of providing an integrative function. Contemporary theorists of organisational design (e.g., Jones 1995) contend that the challenge for organisations is to find ways of balancing differentiation with integration.

More recently, teams have risen in popularity as an integrative structure, in response to the challenges many organisations face in terms of the changing environmental conditions outlined in Chapter One (see for example, Applebaum & Blatt 1994; Berryman 1993; Beyerlein, Johnson & Beyerlein 1997; Ratner 1992). The introduction of teams has usually been complemented with changes aimed at reducing work role differentiation, such as flattening organisational hierarchies and increasing the tasks and roles one person may undertake (e.g., multi-tasking). Given the

central role groups play in this Thesis research examining the impact of the introduction of teams within organisations will be explored more closely.

2.3.1.1.1 Teams

For many years organisational researchers have been investigating team-based work arrangements (Beyerlein et al. 1997; Guzzo & Dickson 1996). A team can be defined as “a distinguishable set of two or more people who interact dynamically, inter-dependently and adaptively toward a common and valued goals/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited lifespan of membership” (Baker & Salas 1992, p. 469). The strength of this definition is that it acknowledges the shared goals and purposes of individuals working as part of an identified group, and part of an intact organisational and social system. In a team, individuals have specific roles and functions that include responsibilities to other members in the team. Guzzo and Dickson (1996) reported that 80 per cent of organisations with 100 or more employees used teams in some way and that 50 per cent of employees surveyed in these organisations were members of at least one team at work. Teams can include quality circles, taskforces and autonomous work groups. In reviewing the impact of teams of organisational effectiveness, the following have been found to have a positive association with performance.

- The degree of team cohesiveness (Guzzo & Shea 1992).
- Heterogeneity within group composition. Diversity within groups has been linked to increased creativity and decision making effectiveness (Bantel & Jackson 1989).
- Familiarity among members. Lower levels of familiarity have been associated with lower productivity (Goodman & Leyden 1991) and the converse also has been found (Dubnicki & Limburg 1991; Watson, Michaelsen & Sharp 1991). It seems that familiarity is important in enhancing productivity but there comes a time when too much familiarity (i.e., a team together for more than two years with no change in membership) leads to a decline in performance.

Teams have also been linked with increased job satisfaction (Beekun 1989; Cordery, Mueller & Smith 1991) and commitment to work, illustrated by decreased absenteeism and tardiness (Barker 1993). According to Smith and Comer (1994, cited in Guzzo & Dickson 1996), self-managing teams can be expected to be more successful in turbulent environments because teams make their own decisions and set their own priorities and thus do not have to wait on a request or decision to move up or down the organisational hierarchy. Some studies have examined the impact of teams on organisational performance, as one of a number of associated changes. These studies generally find that for the implementation of teams to contribute to successful positive organisational change, they need to be seen as one of a set of interventions (Applebaum & Batt 1994; Morgeson, Aiman-Smith & Campion 1997). Dunphy and Bryant (1996) argue that the developmental costs of establishing and maintaining such groups is much neglected and that more rigorous cost-benefit analyses are needed before organisations implement teams.

The strength of the literature of team-work is that it draws attention to the key aspects necessary for team effectiveness. Its weakness is that it overlooks issues of power and control (Sinclair 1995) and the linkages between teams across the organisation. Sinclair (1995) convincingly argues that the key to improving team-work is to recapture insights of teams-as-groups. She contends that for self-managing teams to be effective, they need to attend to issues of leadership and hierarchy and that the notion of a self-managed team as a "leaderless group" (quite fashionable in the management-oriented literature) is a myth. A further weakness is the lack of attention given to the linkages between the team and the rest of the organisation. Guzzo and Dickson (1996), argue that groups are almost always embedded in larger social systems and that future research needs to explore the way in which individuals are likely to belong to more than one group and the impact this has on issues of boundaries and team effectiveness. Thus, the study of teams must be nested within an organisational context, which includes attention to wider structural and cultural influences, a primary focus of this Thesis.

2.3.1.2 Formalisation and centralisation

Formalisation is the degree to which use is made of written rules and procedures to achieve standardised operations and conformity (Jones 1995). In highly formalised operations, the discretion and autonomy of members is limited. In less formalised organisations, there is more freedom to exercise choice. Organisations relying heavily on formalised procedures are likely to be centralised, whereas organisations that do not are likely to be decentralised. Centralisation refers to the degree to which authority, control and activity are distributed vertically within the organisation (Hall 1991). Authority has been decentralised when key decisions can be made by organisational members at a range of levels within a hierarchy. Activity is centralised when work occurs in a central location, rather than being dispersed through a range of locations. Jones (1995) cites the research of Lawrence and Lorsch (1969) who examined organisational characteristics of formalisation and centralisation on organisations operating in different environments. They found that when the environment is perceived as unstable and uncertain, organisations are more successful if they are less formalised and more decentralised. However, this will clearly depend on the nature of the work undertaken in the organisation. Organisations characterised by high reliability, high technology and high intensity need high degrees of formalisation, despite operating in uncertain and complex environments (Von Glinow & Mohrman 1990). This is because workers operating within such workplaces need clearly defined protocols or procedures to follow in the event of the unexpected.

The human-relations movement drew attention to the need for individuals to have some degree of autonomy and control over their working lives, and that structures which emphasise this lead to job satisfaction and commitment whereas structures that do not often lead to worker alienation (Argyris 1976; McGregor 1960). The theme was also addressed within the socio-technical school. The socio-technical school gave rise to a focus on the intersection of social and technical aspects of work organisation to achieve enhanced satisfaction and productivity. One of the classic studies that explored the intersection between organisational structure and their

impacts on individuals was undertaken by Hackman and Oldham (1980). Their work provides a good example of the role of structure and its impact on individuals. They developed a model illustrating the linkage between self determination in work and satisfaction. This theoretical development is important to this Thesis because it introduces the notion of the design of work and its impact on individuals and, hence, of the influence of organisational structure on work activity. Research into work design has also focused attention on the ways in which the physical work-space and the use of technologies provide structuring devices that govern work activity.

2.3.1.3 The physical organisation of the work-space as structuring activity

Some researchers have examined how the physical environment in which people work, and their interaction with their tools, has a structuring influence on the practice of work activity (e.g., Gagliardi 1990; Hutchins & Klausen 1996). Artefacts (such as the physical layout of a building, the technologies used) are devices that mediate work practice and in so doing, structure work activity. In considering organisational design from this perspective, Kolb, Rubin & Osland (1991) cite the work of Steele (1973) who mapped what happened when a change in architecture broke up the information communication pattern within a particular organisation.

Considerable attention has been paid for some time to the interrelationships between technologies, work design and organisational structure (Huber 1990; Hull & Collins 1987; Singh 1986; Thompson 1967; Woodward 1965). Attention to this aspect has led more recently, to a field of practice known as “computer supported collaborative work” (CSCW) (Button 1993). CSCW is about the “study and theory of how people work together, and how the computer and related technologies affect group behaviour” (Greenberg 1991, p. 1) and is concerned with the impact of technologies such as the computer on the structuring of work undertaken. These developments in the study of organisations are also indications of a trend to move toward addressing aspects that are quite often overlooked in the organisational design literature. That is, the micro-practices that occur within organisational structures - at the “local interaction, negotiation and talk” (Engestrom & Middleton 1996b, p. 3) that occurs within organisations, often mediated by structuring devices such as technology. The foundation supporting the emergence of this theorising - the intersection of the social and technical spheres of production has also given rise to the notion of organisational learning (e.g., Senge 1990; Senge & Sterman 1992).

2.3.2 Organisational learning

The rise in popularity of the notion of the “learning organisation” reaches to the core of the problems many organisations face, given the turbulent environmental conditions outlined in Chapter One. Learning is needed for organisations to flourish and survive by enabling them to be more adaptable and responsive to change. Research by Dodgson (1991), for example, in examining success in biotechnology, concluded that it is the differential ability to learn quickly about opportunities that has been responsible for the changing pattern of competitive relationships between firms. However, despite the rhetoric and the proselytising about learning

organisations, a review of the literature reveals a dearth of empirical study. In observing this, Dunphy (1996) concluded that "to date, organizational learning theory is simply a label for a collection of contributions that have little else in common than an ideological commitment to institutionalize processes of learning in organizations" (p. 547). Nevertheless, as has been argued, institutionalising learning in organisations is important for individual and group growth and development and is also imperative in High-3 organisations. Regardless of the paucity of research examining concepts of organisational learning, there are a number of themes emerging from this literature that are of importance to this Thesis. They include: the collective nature of learning (Dixon 1994; Senge, 1990); the employment of cultural and structural concepts to develop frameworks for organisational learning (Hedberg, 1981; Schein, 1996); the notion of different levels of organisational learning (Argyris & Schon 1978; Fiol & Lyles 1985); and acknowledgment of learning as an iterative and continuous process (Dixon 1994).

The notion of collective learning has been explored by Nonaka and Takeuchi (1995). They argued that collective learning is particularly important in generating continuous innovation. In their view, the Japanese companies they have studied have a different understanding of knowledge, distinguishing the tacit and the explicit. The tacit includes both technical "know-how" and beliefs and perspectives, images of reality, while explicit knowledge encompasses the formal and systematic, that which can be communicated as universal principles or codified procedures. They argued that tacit knowledge is not easily communicated, is learned from direct experience, through both mind and body, and involves paying attention to the less formal and systematic side of understanding. Nonaka & Takeuchi (1995) conclude that Japanese companies create new knowledge through "the conversion of tacit knowledge to explicit knowledge" (p. 11) and thus enhance collective learning within the organisation.

Organisational learning has two features that advance it beyond individual learning: communication and shared interpretation (Rousseau & House 1994). "Unless changes in behaviour are communicated among members, organizational learning does not occur" (Rousseau & House 1994, p. 19). Although organizational learning occurs through individuals, it would be a mistake to conclude that organizational learning is nothing but the cumulative result of their members' learning (Dodgson 1991). "Members come and go and leadership changes, but organizations' memories preserve certain behaviours, mental maps, norms and values over time" (Hedberg 1981, p. 3). This occurs because of the collective nature of learning — it is not simply based on the sum of the individuals within the organisation. Individuals in organisations, through being socialised into certain values and norms, continue to reproduce patterns of thinking and acting. It is contended that how learning translates from individuals to organisations critically depends on organisational culture (Schein 1996), where shared norms and values indicate organisational rather than individual learning (Dodgson 1991). Culture as an element of organisation will be discussed later in this review.

What is important to note at this point is that the structure of an organisation significantly influences the way in which these cultural processes interact. Organisational learning is about generating new ideas and knowledge, of innovation and creativity, as well as about adaptation and incremental change. For organisational learning to be advanced, structures are required that help rather than hinder learning. For example, structures and cultures need to be in place so that errors in performance can be detected and corrected in ways that enable the organisation to continue to meet its objectives and to modify those objectives where necessary. However, this is also problematic in practice, since deviations of what is generally perceived as “normal” behaviour usually invite sanction (Easterby-Smith 1997).

One of the key features of organisational learning is the focus on the sharing of information and knowledge across individuals and groups (Dixon 1994; Rousseau & House 1994). Whilst individual learning can be shared, it is not necessarily so. However, organisational learning is inherently interactive, interpretive and integrative (Dixon 1994). Rousseau & House postulate that although people may come and go in organisations, within those organisations are preserved “knowledge, mental maps, norms and values creating a thread of coherence in what characterizes organizational interpretations” (Rousseau & House 1994, pp. 19-20). Although it is not contended in this Thesis that there is such a thing as a “group-mind” (Allport 1924) the resilience of memories and practices to be shared within organisations does provide support for the importance of organisational culture, to be discussed in the next section.

Another problem involved in organisational learning is “unlearning”, or forgetting past behaviour that is redundant or unsuccessful. As situations change what is regarded as relevant knowledge also changes. The challenge for organisations, then, is to find ways of discarding obsolete and potentially misleading knowledge. Hedberg (1981) contended that the discarding activity, what he called “unlearning”, is as important for organisational learning as adding new knowledge, arguing that “slow unlearning is a crucial weakness of many organizations” (Hedberg 1981, p.3).

The problematic relationship between learning and organisation leads Hendry (1996) to ask how far do organisations and the people in them merely behave without learning? This question has implications for theorists of both organisational and learning theory. Theorists of organisations point out that organisations strive for the efficient exploitation of knowledge and competencies and that new learning is in fact rare (Levinthal & March 1993). Similarly, within organisations there is often conformity, control, and deterrence of learning except that which occurs through socialisation. “True learning, in contrast is generally disruptive” (Hendry 1996, p. 622). The issue of dissonance raises the question of whether some kinds of learning are more disruptive than other kinds. In the literature this has been addressed as arguments that learning occurs at different levels.

Fiol and Lyles (1985), for example, distinguished between higher and lower level learning. Senge (1990) differentiated between adaptive and generative learning, Dodgson (1991) separated strategic from tactical learning, and Argyris and Schon (1978) developed the notion of single loop and double loop learning. Single loop learning is when individuals adapt their behaviour to new challenges in the environment but do not question the values or assumptions underpinning the need for change. Double loop learning involves questioning these values and assumptions and may, therefore, lead to greater degree of learning because those underpinning assumptions are evaluated and potentially modified. Argyris and Schon (1978) contended that most organisations do quite well in single loop learning but typically fail to learn on a higher level. One reason for this is what they describe as inhibitory loops. Primary inhibitory learning loops are a self-reinforcing cycle in which errors in action provoke behaviours that reinforce those errors. Secondary inhibitory loops are group and inter-group dynamics that enforce conditions for error (ambiguity, vagueness, etc.). They contend that organisations tend to create learning systems that inhibit double-loop learning, calling into question their norms, objectives and basic policies.

The contributions the organisational learning literature makes to this Thesis includes:

- drawing attention to learning as a collective process (Hendry, 1996; Senge, 1990);
- emphasising the role organisational culture plays in merging individual and collective learning (Schein, 1996);
- identifying that there are different levels involved in learning (Fiol & Lyles 1985).

A conclusion that can be reached at this point is that complex organisations are characterised by a multiplicity of structures and learning processes. Some organisational processes will lead to desirable outcomes and others to undesirable outcomes. Who determines what is desirable or not, is a question raised by Coopey (1995). He criticises most of the organisational learning literature for failing to address issues of power in organisations revealing it as functionalist in approach and supporting management-oriented interests. Indeed, Easterby-Smith (1997) concludes that the biggest risk to the concept of organisational learning is its appropriation into the language of management for crudely instrumental purposes.

2.3.3 Critical organisational theory

Exposing issues of power and control has been the domain of critical organisational theory (Beynon, 1997; Gee, et al. 1996) critical theorists are also interested in structures and processes of work organisation though, as will be shown, what they draw attention to is considerably different. Often referred to as the “labour process” debates, the focus of investigation within critical theory is on the interactions between social relations and technical organisation. The most widely known labour-process research was undertaken by Braverman (1974). Braverman’s “deskilling” thesis was based on the notion that technology (and the ways in which it was structured within work organisation) was being used to wrest control of the production process away from workers. As discussed in Chapter One, some research supports Braverman’s claims (e.g., Kraft 1979; Shaiken 1984) and other research has not supported those claims (e.g., Bailey 1990; Hirschhorn 1984) and has concluded that Braverman’s approach was too deterministic and

simplistic. The labour-process debate has since shifted from examining the impacts of technologies involved in automation of work to a variety of analyses of “post-Fordism”, flexible production, and “lean production” systems involved in work organisation (e.g., Brown 1998; Grint 1991; Grint & Woolgar 1997; Womack, Jones & Roos 1991).

However, the critique offered by the various perspectives within critical organisation theory have been helpful in facilitating discussion and research about the structural preconditions needed for the achievement of a lifelong and just learning society. Critical organisation theory provides an important reminder, however, that issues of power are everyday realities of all organisations and not something that will be avoided by having the “right” organisational structures and cultures. Typical organisational theorising about structure has also been critiqued because such approaches are often “blind”, to issues of gender and how power is used informally within organisations (Green & Cassell 1996; Schein 1996). The informal use of power and influence often comes under the rubric of an organisation’s culture and to understand this concept better, it is necessary to review the role of culture as a link between the individual and the group.

2.3.4 Culture as an element of organisation

Some studies of organisational culture treat it as an homogeneous variable that can be imposed upon the organisation from the top down (e.g., Wellins, Byham & Wilson 1991). This is the basis for much of the “corporate culture” literature (Peters & Waterman 1982). Other studies (e.g., Caulkins 1991; Louis 1986) point to the heterogeneity of organisational cultures. Such heterogeneity is important to this Thesis because understanding why patterns of difference have arisen would provide evidence of what is valued within the organisation and what is learned in work activity within different groups. Because of this heterogeneity of group membership in organisations, cultures can consist of shared, partly shared, non-shared and/or contested values, beliefs and norms (Caulkins 1991). The importance of collective beliefs, social meanings and shared history of experience echoes and complements the concept of constructivism, identified as important in learning (see earlier this Chapter). Therefore, understanding organisational cultures can provide insight into what individuals in a group value and what kinds of organisational changes are likely to be supported or resisted (see for example, Flavin & Bennett 1997; Harper 1996).

Analysis of organisational culture provides evidence of the linkage between individuals and groups because organisations are “culture bearing milieus” (Louis 1986).

They are regularly convening settings, they impose structural interdependencies among people performing tasks, they provide opportunities for affiliation, and they constitute constellations of interest or purposes. As such, they serve as breeding grounds ... for the emergence of locally shared meanings (Louis 1986, p. 79).

Manifestations of organisational culture are evident in a group’s specialised language and symbols (Smircich 1983); collectively held values and beliefs (Schein 1996); myths, stories and legends

(Smircich 1983; McAuley 1994; Alasuutari 1995); and history of experiences (Louis 1986). Trice and Beyer (1984), for example, found that studying story telling and the language organisational members used could provide important insights into the collective values that guide behaviour. This issue will be discussed further in Chapter Eight where it will be shown that story telling is an important means of learning within High-3 workplaces. Telling stories in organisations (whether fact or fiction) provides important clues about cultural norms, as they reveal the kinds of behaviours deemed important to group members and other behaviours that are frowned on. Elements of culture are particularly important to this Thesis as culture provides a means of identifying processes of informal learning.

Culture has been found to play a particularly important role in High-3 work environments (e.g., Bierly & Spender 1995; Helmreich & Merritt 1998; Klein, Bigley & Roberts 1995; Reason 1993; Vaugan 1997; Weick 1987). Weick (1987) argued that as the complexity of organisations and their technology increases, they become more susceptible to accidents. This is particularly so because, the major learning strategies available in other organisations — such as trial and error — are not available in High-3 organisations. One of the reasons for propensity for mistakes in complex organisations is because “the humans who operate and manage complex systems are themselves not sufficiently complex to sense and anticipate the problems generated by those systems” (Weick 1987, p. 112). This is because work activity in these environments requires coordinated efforts and cannot be undertaken by one individual acting alone — no one individual will be able to understand and respond to the complexities occurring within the entire system. Weick concluded that culture can play an important role in enhancing an organisation’s reliability and its capacity to learn from mistakes. In developing Weick’s ideas further, Westrum, (1993) contended that what is required for successful working in organisational environments aiming for high reliability is a culture of conscious inquiry. That is, where individuals and groups are encouraged to observe, to inquire, and to actively bring their conclusions to the attention of others. Evidence supporting the need to strengthen a culture of conscious inquiry within aviation comes from sources such as Hartel and Hartel (1995 p.22), who cite research identifying a lack of adequate communication and coordination between various workers in the aviation system. These results have been supported in other studies (e.g., Helmreich & Merritt 1998).

However, as was discussed earlier, as part of the sociocultural perspectives of learning theory, what happens if these typical ways of thinking found within cultures also need to change? Quite often within organisational culture literature, there is an implicit assumption that the existing community of practice or culture is appropriate and desired and “enculturation” is needed for newcomers to understand existing ways of working. However, these cultures may also lead to conformity and unlearning (Hendry 1996), something identified in this Thesis as inhibiting the development of practices associated with continuous inquiry. Cultures can enhance learning, though they may also sustain existing patterns of belief and thereby learning to conformity, or non-learning (March 1991). That is, culture may reproduce existing relations rather than change.

Collectively held beliefs can be in conflict with one another, especially in periods of organisational change when cultures are contested. In reviewing the literature on organisational learning for the five year period from 1992-1997, Easterby-Smith concluded that culture is a significant cause and effect of organisational learning, and that given this, "it is surprising that it has not been made more of an explicit focus" (Easterby-Smith 1997, p. 1101). This issue is taken up in this Thesis.

This section has summarised the elements of organisational structure and culture found within various perspectives of the organisational literature. The themes that are important to this Thesis arising from the literature on structure and culture includes the:

- processes of differentiation (e.g., job roles and tasks) and integration (e.g., teams) that are used to manage organisational complexity (e.g., Beyerlein et al, 1997; Gailbraith 1979; Guzzo & Dickson 1996);
- ways in which work activity is structured through formalisation (i.e., through rules, policies and procedures which constrain the choices of members) (e.g., Jones 1995; Lawrence & Lorsch 1969);
- ways in which physical layout and tools (e.g., technologies) can structure how work activity is undertaken (e.g., Greenberg 1991; Kolb et al. 1991);
- distribution of power and authority within the organisation (e.g., Coopey 1995; Green & Cassell 1996);
- kinds of groups individuals identify with both inside and outside the organisation and their impact on work activity (e.g., Caulkins 1991; Louis 1986); and
- informal language and story-telling used to describe work activity (e.g., Alasuutari 1995; Trice & Beyer 1984).

So far, this section has focused on the various ways of conceptualising organisations by discussing two of the key elements of organisation: structure and culture. It is also important to review the ways in which organisations traditionally have been researched because, it will be argued, particular methodological perspectives tend to emphasise some aspects of organisational life, overlooking others.

2.4 Investigating work organisation

Methodologically, two broad traditions may be identified in researching organisations: macro- and micro-level approaches (Rousseau & House 1994). Macro-level approaches seek to discern major trends occurring within a population, organisation or society at large, such as the major transformations occurring within work organisation and the implications for skill requirements (e.g., Castells 1997).

Micro-level approaches typically focus on the features of interaction “close up”, that is, on detailed analyses of the use of language and representational practices in interaction (e.g., Boden 1994; Garfinkel 1986). The assumption underpinning this approach is the notion that individuals actively make sense of and construct their immediate social situations. Such research provides detailed ethnographies of work, based on participant-observation in a range of settings (e.g., Orr 1996), such as that found in investigating organisational cultures. From these traditions have emerged research methods involving conversational analysis, where talk is analysed as “the central medium through which the daily working activities of many professionals and organizational representatives are conducted” (Drew & Heritage 1992, p. 3). The strengths of micro-level approaches are that they sensitise researchers and organisational members to the importance of understanding the richness of contextually based systems of meaning (Morgan 1990). The weakness of such approaches is that they can end up glorifying the trivial. Further, by emphasising talk and interaction, micro-level approaches typically overlook historical trends and structural issues that are nevertheless important in work organisation.

Macro-level approaches, on the other hand, typically study major trends and their influence and this is a strength, particularly in periods of major transition. However, in doing so, they quite often overlook the role of human agency in reproducing or changing those trends. Observing this methodological dichotomy has led Engestrom and Middleton (1996b) to conclude that the bulk of organisational research has been either “agency-driven-microsociology-without-history [or] ... historically relevant macrosociology-without-agency”. A conclusion that can be reached from this is that important issues lie outside the analytical lenses traditionally being used in organisational research, regardless of whether management-oriented or critical assumptions underpin the perspective taken. What is missing from these discussions are issues of human agency and how this is embedded in everyday work practice in organisations undergoing transition and change (Engestrom & Middleton 1996b). This gap has led to an increasing call to develop strategies to investigate “the way human practices emerge as work: as societally located and socially intelligible actions of reasoning and communication” (Engestrom & Middleton 1996b, p. 3). This is the focus of this Thesis.

Chapter 3

Research Method

The research design and the methods used in the study are outlined in this Chapter. The research design chosen addresses the methodological gap identified in the literature between macro and micro approaches. The study therefore uncovers the lived experiences of controllers in the workplace and brings to this an analysis of the influences of broader social forces evident in workplace structures and cultures. The Chapter summarises the phases of the research process; the methods of data collection and analysis; how issues of validity were attended to in the study as well as the limitations of the study.

3.1 Introduction

The last Chapter outlined the research relating to the theoretical development that has already occurred and is pertinent to this Thesis. An important focus of the Thesis is the lived experience of people at work. Of interest also are the ways in which individuals create both cultures and structures that in turn enable and constrain individuals in their working lives. Individuals in their interactions with cultures and structures, it is claimed, then change or reproduce existing practices of work organisation. The aim in this Thesis is to integrate these features — to explore the intersection between structures, cultures and learning in the workplace. A methodological approach was needed, therefore, that enabled the integration of micro-analyses of interaction with macro-analyses of culture and structure. This Chapter:

- discusses the kind of research design that was considered appropriate for the research question;
- outlines the strategies for verification that needed to be built into research methods to give the design trustworthiness and authenticity;
- outlines the background to the research project;
- describes the processes involved in site and participant selection, and describes the phases of the research, including the data collection and analysis phases;
- summarises the verification procedures used in the Thesis to maximise validity of the research findings.

3.2 In search of a method

The review of the literature undertaken at the commencement of this study revealed a dearth of theory development evident in the workplace learning field (see Chapter Two). Initial forays into workplaces also provided initial evidence of differences from what the policy documents (as outlined in Chapter One) and what the (non-research based) workplace learning literature were expounding at the time about learning in workplaces. These initial observations have been documented elsewhere (Owen, 1995a). For these reasons, a theory development rather than a theory confirmation approach was considered the most appropriate. A practical focus was also desired in line with collaborative research goals (Lather 1986; Robinson 1987, 1992; Tripp 1990) of involving participants in a mutual examination of their situations. These considerations, together with a recognition of the validity of the perspectives of participants, and further, that those perspectives were likely to be contested from differing viewpoints, were all touchstones used in an attempt to develop an appropriate methodological foundation from which to build this study.

Given the above considerations, a qualitative research design was considered the most appropriate. However, there were some problems with embracing any single qualitative specific tradition, since the methodological approach demanded by the guiding research question for this study needed to both uncover the lived experiences of participants and the influence of structural and cultural elements. This presented a methodological dilemma.

As discussed in the last Chapter, a conceptual and methodological gap was evident between studies focusing either at the micro-interactive level or at the macro-structural level of organisation. Some work had been undertaken linking macro- and micro-studies (e.g., Alexander, Giesen, Munch & Smelser 1987). However these methods did not reveal the lived experiences of the participants involved in the study. Micro-level analyses focusing on interaction, such as conversation analysis (e.g., Taylor & Cameron 1987; Ten Have & Psathas 1995) or grounded theory (e.g., Glaser & Strauss 1967; Strauss & Corbin 1990, 1994), for example, had strengths because they enabled analysis of interaction and lived experiences of participants. However, these approaches were also considered inappropriate because they typically insist that concepts should exclusively emerge out of the observed data and, in doing so, overlook the more remote structural features of work organisation (Layder 1993). As has been discussed, the influence of structural features of organisation is a central feature of this study. It will be argued in this Thesis that structural features do influence interaction though their influence might not be obvious or may be taken for granted.

The development of a suitable research design and method led to four phases of data collection and three phases of data analysis and these will be discussed later in the Chapter. A robust qualitative research design required that certain procedures of verification be incorporated into the development of the design and these will now be outlined.

3.2.1 Procedures for verification in qualitative research design

Considerable debate exists about the kinds of strategies that are appropriate to ensure trustworthiness and authenticity (Lincoln & Guba 1985) in qualitative research. A number of methodologists claim, for example, that the same definitions of reliability and validity can be used across quantitative and qualitative research (e.g., King, Keohane & Verba 1994; Le Compte & Goetz 1982; Lee 1999). Other researchers, however, consider that wholesale adoption of quantitative traditions to qualitative research is specious (e.g., Denzin & Lincoln 1994; Ely, Anzul, Friedman, Garner & Steinmetz 1991; Lincoln & Guba 1985). These researchers believe that other definitions and strategies are needed that are more appropriate to a qualitative research paradigm. In this Thesis, the latter view is taken because the aim of uncovering the lived experiences of participants draws more on a subjectivist (Hassard 1990; Lather 1986, 1993; Van Maanen 1988) epistemological position than an objectivist one (Burrell & Morgan 1979). Given this position, the focus needed also to be on the participants' perspectives, because, as Gillett (1995) concluded "once one sees the tasks of understanding human behaviour as involving interpretation and empathy rather than prediction or control the self-reports of the subject become very important" (p. 111). Nevertheless, it was still important to adopt a conscious interpretative stance, and to look for ways of establishing the trustworthiness of the data.

Qualitative research over the past two decades has developed constructs for evaluating the trustworthiness and authenticity of data and these need to be built into methodological procedures. They are outlined here so that their application in the methods to be discussed later

in the Chapter will be evident. Qualitative researchers look for “trustworthiness”, “credibility”, “transferability”, “dependability” and “confirmability”, as equivalents for “internal validity” “external validity” “reliability” and “objectivity” (Lincoln & Guba 1985). Table 2 summarises the strategies suggested for these procedures of verification.

Table 2: Strategies for verification in qualitative research

PROCEDURES FOR VERIFICATION	STRATEGIES TO BUILD INTO RESEARCH DESIGN	AUTHORS
Trustworthiness	<ul style="list-style-type: none"> • Triangulation of data sources • Thoroughness and accuracy in data collection and recording • Extensive number of informants 	Lincoln & Guba 1985; Miles & Huberman 1984; Patton 1990.
Credibility	<ul style="list-style-type: none"> • Explanation of the researcher's background in the field-study • Prolonged engagement in the field • Negative case analysis • Demonstration of logical chain of evidence 	Miles & Huberman 1984; Patton 1990; Yin 1994.
Transferability	<ul style="list-style-type: none"> • Thick description • Theory development & strength of theoretical argument • Extensiveness of data collection 	Geertz 1983; Lincoln & Guba 1985; Strauss & Corbin 1990.
Dependability	<ul style="list-style-type: none"> • Time series collection of data • Thoroughness of data documentation 	Maxwell 1996; Yin 1994.
Confirmability	<ul style="list-style-type: none"> • Member checks • Data methods documented in detail 	Lather 1991; Miles & Huberman 1984.

To ensure “trustworthiness” of data, researchers need to make use of multiple and different sources, methods and theories (Patton 1990) and to interview an extensive number of informants to provide supporting evidence (Miles & Huberman 1984). “Credibility” of the findings can be strengthened by prolonged engagement in the field and building trust with participants (Yin 1994), something that requires reciprocity (Lather 1991). Reciprocity, giving and receiving information and assistance, is particularly important in studies designed with a practical focus (Robinson 1987, 1992). Patton (1990) contended that the credibility of a qualitative inquiry is, in part, dependent on the credibility of the researcher operating in the field. Researchers should therefore outline what they bring to the study in terms of their qualifications, experience and perspective in the area being researched because, according to Patton (1990), the credibility of the researcher affects how the findings are received. The credibility of the study also rests on the strength of the theoretical argument advanced and the degree to which there is evidence that

negative cases are analysed and used to improve the theoretical fit between the data and the theory development process (Miles & Huberman 1985).

The strength of the theoretical argument is also a key feature of demonstrating “transferability” as well as credibility (Strauss & Corbin 1990). Transferability of data occurs at two levels: the degree to which the findings are transferable within the population studied and the degree to which the results are transferable to other populations. Thick, rich description adds to verification according to Lincoln & Guba (1985) because it allows the reader to make decisions regarding transferability to other settings because of the degree of detail in the information provided. “Dependability” of results relates to the issue of ensuring data collected is stable and consistent over time. Dependability is enhanced by strategies already discussed, such as involvement in the field for extensive periods of time and extensive interviewing. Dependability is also enhanced by collecting data as part of an iterative process (Yin 1994). Dependability and confirmability are enhanced if threats to inaccuracy in data collection are reduced (Maxwell 1996). These strategies can include, for example, use of audio- or video-tape and verbatim transcripts. “Confirmability” relates to the issue of whether there is a correspondence between what the study’s participants meant and what the researcher inferred. One way of ensuring confirmability is through member checks of the data (Lincoln & Guba 1985). Confirmability can also mean something akin to the notion of replicability (e.g., Lee 1999) — that is, to provide the reader with sufficient detail so that he or she can assess whether the data would be reproducible in subsequent analyses.

The application of these procedures to ensure the trustworthiness and authenticity of the study will be demonstrated later in the Chapter within a discussion of the research methods that were employed. The decision making processes involved in developing the method used in the study will be discussed shortly. Before doing so, however, it is first necessary to describe the approach that has been taken in thinking about linking lived experience and context.

3.2.2 Mapping the intersection between lived experience and context

The first methodological challenge was to establish the potential sites for linking the lived experience of people with the contextual features that may influence their learning in the workplace. Layder (1993) provided an appropriate option for this challenge, by advocating what he called a “resource map” for research which outlined the key features of social life and which represented different levels of analysis and dimensions of research which have proved useful in past social research. As stated in Chapter One, one of the intentions of this research is to demonstrate how learning in a workplace, an activity predominantly involving individuals in situated relationships with others, is influenced by and is interwoven with indirect factors such as macro-economic policies, reforms of organisational structure and strategic directions, and history. Layder’s map (outlined in Table 3) is useful in this Thesis because it focuses attention on the structural features in social life, defined in Layder’s map as “context” and “setting” as well as to the micro features of social life, defined in the map as “situated activity” and “self”.

Table 3: The research map proposed by Layder

H I S T O R Y	RESEARCH ELEMENT	RESEARCH FOCUS	FOCUS IN THESIS
	Context	Macro social forms (e.g., globalisation, capitalism)	Structure
	Setting	Immediate environment of social activity (e.g., structures of work organisation)	Structure
	Situated Activity	Dynamics of face to face interaction (social and interpersonal processes e.g., cultures)	Culture
	Self	Biographical, lived experience (e.g., perspectives of individuals)	Participants' perspectives

Source: Layder 1993, p. 8

The linkages between context and lived experience can be addressed by focusing attention on the links between the various levels identified by Layder (1993). For this Thesis, examples of what have been called “macro-contexts” (after Layder, 1993) include the political, economic and wider social situation relevant to the focus of the research (this will be discussed in Chapter Four). The “setting” described the organising features structuring the work activity (e.g., modes of authority, hierarchies of accountability, and the use of technologies — see Chapter Two). “Situated activity” identifies the interactions individuals have with others in their work and the ways in which social aspects of interaction, identified in this Thesis as organisational cultures (e.g., collectively held beliefs, values and norms) influence those interactions. The “setting” and “situated activity” (as structures and cultures) are discussed in Chapter Five. The “self” identifies individuals’ lived experiences within the work organisation, and will be discussed throughout the findings Chapters (Seven to Ten). Finally, the historical dimension of social research is also important. For Layder, “history represents the temporal dimension through which all the other elements move” (1993, p. 101). History is important in this Thesis because, as activity theorists contend, history is present to some extent in all current practices (Engestrom, 1996a). History and change in ATC work is discussed in Chapter Eleven.

Historical ways of thinking and practice coexist “as layers within one and the same current activity system” (Engestrom, 1996a p. 92). Although, as Layder (1993) suggested, it is “impossible to keep questions about situated activity separate from those about the setting in which it takes place” (p. 89). For the purposes of this Thesis, then, they need to be teased out and presented in a way more akin to a “snap-shot” rather than in the dynamic and relational way these features are played out in organisational life. The ways in which interactional and structural data were analysed will be detailed later in the chapter. To begin to outline the processes

involved in the research, the next section will first provide the background to the research and of the researcher in this particular workplace. To do so is to address the issue of "Credibility" discussed in Table 2 above.

3.3 Background to the research

Throughout the rest of this Chapter, the pronoun "I" will be used to discuss my involvement in the field and the ways in which I established the methods used in the study. The history of my involvement with the organisation will first be outlined, because, as Patton (1990) contended "the credibility of qualitative inquiry is especially dependent on the credibility of the researcher because the researcher is the instrument of data collection and the centre of the analytic process" (p. 461).

Observing the processes involved in instructing trainee air traffic controllers commenced for me in 1991, when six of the 17 college instructors employed at the Centre for Air Traffic Services enrolled in a Diploma of Teaching in Adult and Vocational Education (Dip. Teach. [AVE]), at the University of Tasmania. In 1989, the Centre for Air Traffic Services had been relocated from Melbourne to the University of Tasmania at Launceston. Air traffic control trainees were enrolled in a Diploma of Applied Science and academic staff from the University and staff from the (then) Civil Aviation Authority (CAA) were involved in their tuition. Academic subjects were The University's academic staff taught academic subjects in lectures and tutorials and assessment of ATC work practice applying these theoretical concepts was supervised by CAA staff in a purpose built simulator. The CAA instructors wanted to have a greater understanding of the principles of learning and teaching and so enrolled in the Diploma of Teaching in 1991.

In undertaking their Diploma of Teaching, the instructors were required to have their teaching observed on a series of occasions and to undertake special research projects examining teaching and learning processes. These were observed and supervised by me. Following the decision by the CAA in 1992 to cease training air traffic controllers at the Launceston facility, I was approached by the Authority to provide staff development for the College Instructors not enrolled in the Diploma of Teaching. For the period of 1992-1994, I provided basic instructional methods training to all new college instructors. This consisted of approximately ten (10) training courses over the period of two years and 51 instructors. In addition, I conducted a variety of staff development activities for instructors and these included courses in coaching, conflict resolution and strategic planning.

During this time, I developed some understanding of the kinds of problems instructors faced in attempting to work with trainees, as well as the influence of workplace norms on reproducing existing ways of behaving and also on resistance to change. I noted that, despite understanding and being able to demonstrate sound instructional practices in the training room, and indeed sometimes displaying great enthusiasm for them, instructors quickly slipped back into old ways of working in the simulator. Furthermore, not all instructors accepted the notions of adult

learning, or of instructional methods taught in the course. One particular instructional methods course is worthy of note because of participants' outright rejection of concepts contained in the course and thus the failure of the course to meet its objectives. In the final day discussion and evaluation of the course, the instructors explained why they had resisted accepting the course content: they were concerned that what I was doing was trying to "teach the unteachable". In their view, air traffic control was not something that could be taught. Air traffic controllers were, in their words, "born, not made". Therefore, none of the instructional strategies discussed on the course were of value. Moreover, application of such practices (aimed at enhancing instruction and making learning air traffic control easier) could result in weak trainees getting through the system. On reflection it seemed that, for these instructors at least, training was akin to a rite of passage, as trainees had to "prove" their worth by getting through the course (in some circumstances), almost despite the training officer.

Toward the end of 1994, I was approached by human resources staff at the Civil Aviation Authority and asked to undertake national delivery of on-the-job-instructor-training. I declined, as I had moved to full-time enrolment in my PhD candidature. Discussions commenced however, on ways in which I could assist Authority staff in developing understanding about on-the-job training and learning as well as undertaking my PhD.

At this time I was requested also to provide an "advanced" course of instructor training and to facilitate a meeting in Canberra of a newly formed group called The Advanced Air Traffic System [TAAATS] Operational Instructors (n=20). The meeting was the first extensive briefing of staff employed to learn about and implement training for transition to TAAATS. Briefings were provided by staff of the CAA and Thomson Radar (the organisation contracted by the Commonwealth Government to provide the software, hardware and expertise for development and implementation). Following the success of this week, Thomson approached me to accompany the group to Paris, and to provide specialist educational support to Thomson instructors who were to teach the Australian air traffic control staff about the new system. The Australian staff, in Paris during the first quarter of 1995 to undertake the course, were then to take their understanding back to Australia and to prepare instructional materials for the rest of the air traffic control population as part of the transition to the new system. Thomson also contracted me to chair or facilitate the delivery of the Paris phase of the training and to evaluate it (Owen 1995b). The facilitation included chairing seminar presentations delivered by Thomson staff; chairing three forums involving European experts on human factors and advanced technologies, and implementing transitions towards advanced aviation systems; working with tutorial groups as they discussed and researched issues arising from the presentations; and accompanying the group on visits to a range of research facilities and operational sites in Europe (e.g., Airbus Industrie, Toulouse; the European Air Traffic Control Centre, Maastricht). I accepted this opportunity and played a facilitative role for the duration of the European-based training.

Upon return to Australia, I negotiated access to Air Traffic Control Centres and commenced interviews with instructors and trainees and others involved in training activity in Melbourne, Brisbane and Perth (as these were the sites selected for the study).

The above description demonstrates, I believe, my extensive involvement in the field of study prior to the data collection and analysis phases. These phases will now be outlined, and strategies that were included to enhance the trustworthiness of the data are discussed.

3.3.1 Selection of sites to conduct the study

As Chapter Five will outline, air traffic control operations, at the time of data collection (1995-1996) were being consolidated to two Centres: Brisbane and Melbourne. These Centres were therefore selected as two of the sites for interviews because this was where most change was occurring and because these would be the primary Centres of operation in the future. A further site was selected (Perth) because the site represented a small Centre and one undergoing downsizing as Melbourne consolidated (i.e., took over operations of) its airspace. Access to Centres and support with travel and accommodation to the sites were provided by AirServices Australia's Human Resource Division.

3.3.2 Phases of the Research

A range of different data collection techniques was used in the study. These included observations, interviews and document analysis. Interviews were conducted with people in different Centres, undertaking different roles. Data were circulated (during phases three and four) to participants to review the findings and selected participants were involved in interpreting the findings. The phases are summarised in Table 4.

Table 4: Phases of the research study

PHASE	PURPOSE	TIMELINE
Phase 1	Familiarisation	1993-1994
Phase 2	Understanding working activity and change in ATC	1995
Phase 3	Investigating on-the-job learning	1995
Phase 4	Theme confirmation, commencement of theory development, write up	1996-1998

3.3.2.1 Phase 1. Familiarisation

Interviews were conducted during 1993 and 1994 with instructors working at the Centre for Air Traffic Services, Launceston, with air traffic control managers, staff working in training annexes, team leaders and on-the-job training instructors (n=15). Interviews had been also conducted

with instructors in organisations in other industries (n=16). Two of these workplaces involved High-3 work (an ambulance service and neo-natal intensive care), whereas others involved manufacturing and provision of electrical services. It was from comparing the experiences of instructors in air traffic control with instructors in other industries that I realised the similarities between air traffic controller and other workplace contexts, with respect to workplace learning issues. This phase of the research is not extensively documented here as it has been documented elsewhere (Owen, 1995a). Included for data in this study are just the interviews pertaining to AirServices Australia (and its predecessor, the Civil Aviation Authority).

3.3.2.2 Phase 2. Technological Change and Work-based learning

This part of the study consisted of interviewing 17 of the 25 air traffic control staff involved in the European training and preparing for the transition to TAAATS. These interviews consisted of discussions about their own experiences of learning with air traffic control, how they were approaching their own on-the-job learning tasks about TAAATS, as well as their perceptions of current work practices and the changes TAAATS will bring. Some staff (n=5) were interviewed on multiple occasions, as they proceeded with their work. This phase assisted in providing an understanding of the nature of the work and the demands placed on individuals, groups and the organisational system, both now and in the future.

3.3.2.3 Phase 3. On-the-job learning of air traffic control

During 1995, 52 interviews were conducted with trainees and instructors directly involved in on the job training in the following work sections (described more fully in Chapter Six) Approach (n=7), Arrivals (n=7), Enroute (n=13) and Tower (n=6). Interviews were also conducted with people involved in training annexes (n=7) and others with responsibilities for on-the-job training, for example, team leaders, team training specialists, staff involved in quality assurance and human resources, management (n=12). Data gleaned from this and the next phase form the empirical basis of this Thesis, although some data is drawn also from Phases 1 and 2.

3.3.2.4 Phase 4. Theme confirmation and theory development

This phase occurred during 1996 and followed the transcribing and analysis of the interviews in Phase 3. To further investigate the patterns and themes emerging in the data, I returned to the Melbourne AACC on a further three occasions. The purpose of these visits was to feedback data to those who had expressed interest; to conduct further discussions with training annexe staff about emerging themes in the data, their interpretation and possible changes in practices; to reinterview some of the existing participants to check data; and, to conduct further interviews with new participants (n=16). During this phase four instructors and four new recruit trainees were interviewed on multiple (i.e., on two or three) occasions and their progress throughout the entire on-the-job training phase monitored. This is in line with strategies aimed at enhancing the dependability of the research methods used (see Table 2), by utilising different data collection strategies that involved interviews over time.

All phases of the research involved my own observations at the site. These observations were informal in that they did not involve a check-sheet for data collection purposes and served more to provide a means of triangulation of comments made in interviews. In this way they enhanced the trustworthiness of the data collection process (see Table 2). Data continues to be fed-back to staff in the organisation and discussions held regarding their implications.

3.3.3 Process of data collection

Interviews conducted were between 30 minutes and three hours in duration. A series of prepared questions guided the initial interview (see Appendix 2), though not all questions were asked of all participants. At times interview topics diverged to follow a particular point made by the participant. At other times set questions were not asked because answers had already been provided by the participant in response to an earlier question. Sometimes, the participant only had a short period of time available for the interview (e.g., a shift break) and this precluded all interview questions being addressed. As analysis commenced and themes were identified, certain areas of questioning received particular attention (see next section "Data collection and analysis"). Follow-up interviews, where they occurred, addressed questions that may not have been asked initially or were used to check out the respondent's views on a particular theme that had emerged in another interview and needed to be further investigated. These strategies of triangulation of themes across multiple data sources enhance the veracity of the research method process (see Table 2).

At the commencement of each interview, participants were asked their permission to audio-tape record the interview. The purpose of the interview and how the data would be used were explained in accordance with University ethical guidelines (see Appendix 3). At this stage confidentiality issues were discussed. This included: advising participants of the timeline of the project (i.e., that findings which included excerpts from the interviews would not be publicly available for some 18 months after the data collection phase); how data would be stored (see Appendix 3); and, that any identifying features that were present in a transcript would be changed. Consent was obtained separately for (a) participation in the interview, and (b) inclusion of the interview data in the study. Participants were advised that they would not be required to give consent for the data to be included in the study until the end of the interview. I believed that to ask participants to provide such consent beforehand was unreasonable. At the end of each interview, participants were asked if they were comfortable for the recording to be used in the research, in accordance with confidentiality criteria outlined in Appendix 3. I explained that at the end of the interview, participants could keep the tape recording if they were not happy providing consent. In one case a participant said that she was not sure and wanted me to show what parts of the interview transcription would be used. In another the participant wanted a copy of the recording. A number of participants wanted assurance that no-one else would listen to the tape and that identifying factors would be removed. One participant was happy to take part in the interview but declined permission to be recorded. In this case notes were taken. In another case, the participant was unsure about providing ethical clearance for the data to be used in the study. This interview was not used in the research. There were a number of occasions

where participants asked me to turn the tape recorder off so that they could elaborate on a point for my understanding but not for the recording. In all cases, these requests were met.

3.3.3.1 Issues of power in interviewing

Whilst I acknowledge that there are power differences between researcher and the researched (see Lather 1986), I believe that, for the most of the interviewees, I was not regarded as someone with power over them. As a university researcher and “outsider”, most people seemed to regard me with curious bemusement. Like many professions, power and status in air traffic control come from being able to do the job or being in a position of influence within the organisation. Since I held neither position, and my sponsoring contacts were within Human Resources (a department viewed with derision by many operational staff), I held none of the power that was regarded as important, particularly in this operational context. In this environment, academic knowledge is commonly regarded as impotent and unhelpful. Indeed, some organisational members would jokingly describe me as “that artie fartie little academic wanker”. Another, described me as a “camp follower”, since a widespread belief within the organisation was that anyone working within the organisation, in any capacity, who was not operationally current (i.e., an air traffic controller) was, at best, of limited use and, at worst, parasitic.

Notwithstanding the lack of substantial evidence of a power imbalance, there were five interviewees (of a total of 100) who seemed particularly guarded in their responses. In addition to the requests and uncertainty outlined in Section 3.3.3, there was one interviewee who, for example, “couldn’t think of anything” that had been difficult to learn and couldn’t describe any problems that he faced or knew about. Another said she was happy to talk but then seemed to obstruct the interview process by providing only vague and evasive answers.

3.3.3.2 Participant selection

Participants were selected for interview in a number of ways. Prior to arrival at a Centre, the Training Annexe supervisor was contacted and asked to organise a set of interviews for the research. I already had contact with the Training Annexe supervisors involved through participation in different human resources meetings. Training Annexe supervisors were sent an outline of the purpose of the research, along with the list of intended questions and an outline of the kinds of people requested for interview. This included asking for a balance of stakeholders involved in training (e.g., trainees, instructors, team leaders) and a balance of staff involved in different streams (Approach, Enroute, Tower). Supervisors were asked also to seek involvement of people with a range of positive and negative attitudes toward training. In all cases, before the first site visit, Training Annexe supervisors distributed the written material to team leaders working in the Centre. This resulted in a combination of people volunteering to participate and in the Training Annexe supervisors using their own networks to invite participation. On arrival at a particular Centre my own network of informants would be used to check if those who were to be interviewed did represent a range of views and opinions about learning in the ATC workplace. In all cases, this request had been met. The reason for this can also be explained because it was

in the interests of the Training Annexe supervisors to have a range of positive and negative views canvassed. They too wanted to better understand why programs such as on-the-job-training instruction sometimes did not deliver desirable outcomes. Such information would hopefully assist them to become more effective.

Some initial interviews were set up through serendipity. Having an hour or two to spare, I would loiter around the Training Annexe conversing with those present. Invariably, staff visiting the Annexe (who had not met me before) would ask who I was, or be introduced to me. This often provided an opportunity, for example, for the Training Annexe supervisor to suggest that the staff member might like to have a chat — “be a good opportunity for you to talk about that problem child you had” (meaning a difficult trainee) — and so individuals would find themselves ensconced in a room with me and describing their most recent training experience. Other interviews were established through networking. Interviews also were set up as a result of my sitting-in and observing air traffic control at the console. Controllers nearby would ask what I was doing. A conversation would start up, punctuated by air traffic control activity. Comments and concerns were elaborated on away from the console. Sometimes, having had a discussion with one staff member, they would suggest someone else: “There he is now, I’ll just ask him”. Roster breaks were arranged.

For the most part, I found the people I had contact with eager and willing to help. Many were concerned about the activity of training and learning and wanted to contribute. Others had a particular argument to put about the training system or air traffic control in general and what was right or wrong with it. Others wanted me to understand why they believed certain things could or could not be done: why for example, they thought I was on the wrong track even asking about training in the first place (since they believed that the skill of controlling had much to do with innate ability and little to do with learning).

3.3.3.3 Data collection and analysis

Because of the nature of the locations of research sites (Melbourne, Brisbane and Perth) and my location in Hobart, data were generally collected in batches of 12-15 interviews. A typical site visit, spread over 3-4 days, would involve general discussions with human resources staff, observation of (and some participation in) meetings, informal observation of air traffic control work and interviews. On return to Hobart, I would listen to all the tapes and select those for transcription. Transcribing and initial analysis (described below) usually occurred before the next site visit. These procedures are in line with strategies aimed at enhancing dependability in research (see Table 2), by using iterative processes and data collected over time.

In the early part of the main empirical phases of the research, 30 of the 60 interviews conducted were transcribed fully. Criteria for transcription selection included ensuring that a balance of trainees and instructors, across sectors and across Centres was obtained. Interviews were also selected because they contained interesting stories, because participants were articulate, captured

a particular dilemma or were describing beliefs opposed to typical views of instructing and learning. Interviews not selected for transcription therefore were those where sound quality was poor or where no significant insights were obtained in listening to the tape. Upon receipt of the transcription, transcribed tapes were listened to again to check the accuracy of the transcription and to insert any phrases unknown to the transcriber. Given the jargon associated with air traffic control, there were many instances where this was necessary. These strategies are in line with those suggested in Table 2 to enhance both the trustability and dependability of the research process.

A list of descriptive codes was developed inductively following Tesch (1990). When the interviews were transcribed five were selected and cut and pasted on chart paper along a wall, where the topics being described in the interviews were written in the margin alongside each of the relevant portions. Once this had been conducted for each of the interviews, the topics were compared to identify those present in all interviews, those that appeared in less than five but that seemed salient, and those that were not. These topics were then grouped together, in some cases, collapsed with others or reframed and were then hierarchically ordered under subsuming categories. In this way the indexing system was developed. Following this process, the tentative organising system was manually applied to all the transcriptions available at the time, and the codes and categories re-evaluated once again. This led to some codes being moved, others collapsed or reframed and others expanded.

A final set of codes (see Appendix 4) was developed and applied to all the transcribed interviews using NUD*IST (Non-numeric, Unstructured, Data Information Searching and Theorising) a software program for qualitative data analysis (QSR 4, 1997; Richards & Richards, 1991, 1994). NUD*IST organises data into a system of nodes, which are then grouped together depending on the researcher's classification system, in a tree-structure. At the completion of the interviews these were reassessed and all the non-transcribed interviews were listened to once again and the dialogue mapped against the existing list of codes. Where a tape contained a good example of a particular code, then this excerpt was transcribed, resulting in a further 18 interviews being transcribed partially. After the data had been collected, the data analysis continued and new codes were added. An example of the application to an interview transcript and the application of the codes can be found in Appendix 5. A breakdown of interviews conducted and interviews transcribed in the study are included in Table 5.

Table 5: Summary of data transcription and use in data analysis for the study

PHASE	INTERVIEWS	FULLY TRANSCRIBE D	PART TRANS.	TOTAL (%)
One	15	12	4	16 (50%)
Two	17			
Three*	52	30	9	39 (75%)
Four*	16	8	5	13 (81%)
Total	100	50	18	68 (68%)

* main phases of data collection for this study

The codes and categories were developed from both reading and listening to the data and from the conceptual framework discussed in Chapter Two. This is in line with qualitative research practice described by Miles and Huberman (1984) and Tesch (1990). As data were coded, further information was required on specific themes found to be important in the interviews collected thus far. In subsequent interviews conducted on the next site visit, particular attention would be paid to specific themes (e.g., the role of confidence in work performance, the role of teams). This resulted in certain questions being dropped from the initial set and greater probing of examples and conditions necessary to better understand the emerging themes.

3.3.4 Phases of data analysis

Three distinct phases can be identified in the data analysis. The first was essentially descriptive. I worked inductively with the transcripts to build up a picture of the worlds of participants. It was at this stage that I realised the key features of ATC work experience and the importance of continuous learning in High-3 work. The traditional organisational theories, for example, about the importance to job satisfaction of control over one's work and the capacity to regulate it, did not seem to be played out in this workplace (as will be discussed in Chapter Seven, they occurred within the micro-practices within a highly regulated environment). This phase yielded the codes and categories found in Appendix 4, as outlined above. Although this phase has continued over the period of Thesis writing, the main phase occurred throughout 1995/1996.

The second phase occurred when I realised that the influences of culture and structure were not easily observable in my data. There were some obvious examples, though these provided at best tentative conclusions to be confirmed. To tease out and confirm these tentative conclusions I needed to return to the literature and to the field. More probing was needed, for example, about participant perspectives on norms of work practice and how these practices were accounted for, and more attention needed to be given to structural issues such as, for example, the influence of team-work. This phase occurred throughout 1996/1997, and accounts for why many of the transcripts used to provide evidence of culture for example, are later ones in the data collection

process. This phase was largely deductive, as I trawled for evidence of how the literature defined culture and structure and then looked for evidence of these conceptualisations in the data.

The third phase occurred during 1998, when, having documented the influence of culture and structure on work activity and accredited training programs, I was left with the unanswered question "what on earth does this say about learning?" The approach taken at this point, as I attempted to interweave insights from the earlier phases with the processes of learning, is mirrored in the following description by Engestrom (1994):

... the models by which we represent the world are in constant movement between the external and internal spheres: from externally visible bodily movements and postures to internal sensations and feelings and vice versa; from external pictures to mental images and vice versa; from verbal or mathematical thought to written text and vice versa. Thus models are not exclusively individual and private; they are also shared cultural patterns of thought and action (p. 6).

Thus, the ideas and arguments that emerged during this phase were developed both inductively and deductively, through a dialectical process that pulled between: what I had read (in the literature); what I had heard (in the interviews) or observed; and then, further, through changing what was "known" through dialogue with members of ASA, involving them in making sense of the data.

One of the key features of using computer programs such as NUD*IST is that insights gained in the conceptual development process can be documented through memo-writing at particular nodes where data is stored. Memo-writing has been identified as an important aid in theory-building (Weaver & Atkinson 1994). NUD*IST allows memos to be written when working with data. These memos allow the researcher to engage in "the theorizing write-up of ideas about codes and their relationships as they strike the analyst whilst coding ... it exhausts the momentary ideation based on data with perhaps little conceptual elaboration" (Glaser 1978, pp. 83-84). A copy of an example of some coding stored at the node "role of confidence" and the memo for that node is attached in Appendix 6. Following Bustin (1997), the NUD*IST data tree was divided at this time into two branches: all the empirical data placed under a node titled "descriptive data" and another branch created titled "conceptual development". The conceptual nodes relate back to the various combinations of the empirically derived descriptive data nodes (see Appendix 4) and thus to the descriptive data, through the information contained in the memos created at each node. This, in Strauss & Corbin's terms (1990), is called "second order" data analysis and begins the theory building process.

In the chapters that follow, these processes of data analysis are presented in a different order to that described above. To give the reader an understanding of the context, the next section contains two chapters that outline the contextual features of the aviation industry and the

workplace, including elements of structure and culture. This “rich description” is provided to enhance the transferability of the findings to allow the reader to develop a sufficient understanding to be able to transfer the information contained in this Thesis to other contexts (see Table 2). This will be followed by Section Three that commences with a chapter outlining the conceptual structure used to represent the data (Chapter Six). The structure is then used as a framework to analyse the data over the next four Chapters (Chapters Seven to Ten) to document the lived experiences of individuals in relation with others as they engage in informal learning as part of work activity and accredited learning on-the-job. Chapters Eleven and Twelve then draw the findings together to discuss their implications for contemporary workplaces undergoing change and to consider what structures and cultures are needed to support the development of educative work environments.

3.3.5 Protocols used in the Thesis

In this Thesis, interview excerpts have been used to illustrate certain findings. When quoting from an interview, an “I” represents the interviewer and an “R” represents the respondent. Pauses in the respondent’s comments are illustrated by Where parts of the transcript have been omitted for brevity, a “/” represents a break in the actual quotation. When words have been inserted into the quotation to assist with understanding, brackets, [] have been used. Where possible the question that the respondent is answering is included with the response to situate that response in the context of the interview. This is in line with strategies aiming to enhance the trustworthiness and dependability of the research methods used (see Table 2).

Summary data are provided at the end of each interview quotation. Provided are the interview number, the position the person occupied in at that time of interview (e.g., a trainee, instructor, controller, team leader), the sector and Centre where the person was working. In some cases this information has been withheld to protect the identity of the respondent. In relation to the number allocated to the interview, it should be noted that the interview numbers extend beyond 100 because the early interviews undertaken at other workplaces, which included those undertaken in Phase One, had initially been imported into the NUD*IST data analysis software program (before the decision was taken to just concentrate on this one organisation — see section 3.5 below).

3.4 Summary of verification procedures used in the Thesis

Table 6 (see page 67) provides a summary of the strategies used in the Thesis to enhance the veracity of the research procedures. The Table demonstrates that procedures have been built into the research methods used to enhance the study’s trustworthiness, credibility, transferability, dependability and confirmability.

Table 6: Strategies used to verify the study's authenticity

PROCEDURES FOR VERIFICATION	STRATEGIES TO BUILD INTO RESEARCH DESIGN
<u>Trustworthiness</u> (triangulation, consistency, accuracy, extensiveness)	<ul style="list-style-type: none"> • Comparison of responses across phases; sectors; Centres; stakeholders • Comparison of data collection in interviews with observations • Time-series data collection in Phase four compared with one-off and repeat interviews in Phase three • Extensive number of informants (N=100)
<u>Credibility</u> (background, prolonged engagement, negative case analysis, chain of evidence)	<ul style="list-style-type: none"> • Demonstrated and prolonged researcher background in the field-study (1991-1998) • Prolonged data collection (1993-1996) • The findings chapters will show the chain of evidence presented which is grounded in the empirical data • The theory developed accounts for negative cases and disconfirming evidence (e.g., why some instructors would adopt practices supporting learning and some did not — see Findings chapters)
<u>Transferability</u> (thick description, extensiveness of data collection)	<ul style="list-style-type: none"> • Thick description provided throughout dissertation • Extensiveness of use of data to demonstrate themes from perspectives of stakeholders (trainees/instructors; comparison of comments between sectors and across Centres)
<u>Dependability</u> (time series, thoroughness of data documentation)	<ul style="list-style-type: none"> • Data collected over a range of time periods • Repeat interviews • Audio-tape recordings and extensive full and partial transcription
<u>Confirmability</u> (member checks, data documentation)	<ul style="list-style-type: none"> • Reports prepared for stakeholders based on data (Owen 1996a) • Regular discussions with organisational staff based on data • Presentations to industry forums about findings (Owen 1996b, 1997a, 1997b, 1998) • Member checks on dissertation (see Appendix 1)

3.5 Limitations of the Study

There are three fundamental limitations to this study: (i) only one work organisation was selected; (ii) the type of organisation selected does not represent emerging organisational forms; and, (iii) the training that occurs within the selected organisation is not linked to national government initiatives. Had more than one work organisation been included this would have enabled a comparison across work contexts. Initially, I had planned to include more than one work organisation in the study. However, when I commenced fieldwork in AirServices Australia, it soon became apparent that this was a rich resource and to do justice to it would require considerable depth of understanding and attention to detail. A decision was then taken to concentrate on this one case, rather than undertaking a study with less depth across multiple organisations.

The type of work organisation chosen is also a limitation. Although the work chosen does provide a good example of the future characteristics of work in High-3 workplaces, it does not provide a good example of the types of work organisation that are likely to be emerging in the 21st century. AirServices Australia is a large bureaucratic structure and, as such, is not an example of future work organisations that are likely to be much smaller and more flexible. However, the organisation chosen does represent a kind of organisation that is still going to play a prominent role in the future. It provides also a valuable example of many of the changes and challenges facing many organisations of whatever size and structure.

In Australia, as indicated in Chapter One, there is a national policy agenda encouraging training development in organisations. As part of this policy direction, the Australian Government has introduced a national framework for recognition of skills and accreditation. This, in part, is to secure standardisation of curriculum content, so that portability of skills and their recognition can occur between organisations involved in the same industry and between industries. Because AirServices Australia organises and accredits its own training program, and is not reliant on the Government for education services, it has no formal linkage into this accreditation framework. Some might see this as a strength, since part of the Government's agenda is to establish a greater involvement and responsibility for industry in training. However, this is also a limitation, since this study sheds no insight into the workings of the national training reform agenda, something with which many organisations in Australia are involved.

3.6 Conclusion

This Chapter has discussed the research design and verification procedures appropriate for the study. The research design chosen was one which attempted to explore the subjective experiences of organisational participants together with attention to structural and cultural issues and to investigate how these in turn influence learning. It has documented the background to the research study and the processes used in site and participant selection. The research method used involved semi-structured interviews and informal observations at three ATC locations

(Melbourne, Brisbane, and Perth). Interviews were conducted also on multiple occasions with a number of interested staff. The data collection included:

- a familiarisation phase,
- a phase of involvement with key staff in the organisation as it prepared to undertake a major technological change;
- a fieldwork phase involving interviews with controllers, trainees, on-the-job-instructors, team leaders, educational specialists, managers and human resource staff and then
- a follow-up phase which included reinterviewing some staff as well as initiating multiple interviewees with six trainees and instructors as they undertook training.

Analysis of the data included: first working inductively to draw out the perceptions of participants; next working deductively to identify evidence of structure and culture; and then, finally combining both approaches to draw together the implications of what structural and cultural influences might mean for processes of learning in this workplace. The next section will map out the context for learning in the workplace studied. It will describe the changes occurring within the aviation industry and then will discuss the organisational structures and cultures present in the ATC workplace.

Section Two

The context

This section sets out the context and discusses changes occurring within the aviation industry and the air traffic control workplace. Chapter Four outlines the challenges and changes facing the aviation industry and how these changes have influenced the organisation of air traffic control, including the organisation of training. Chapter Five specifically examines the air traffic control workplace. In doing so it will address the first research question "What structures and cultures can be identified within the workplace studied?"

Chapter 4

The Aviation industry: Challenge and change

This chapter introduces changes occurring within the aviation industry. It then outlines how these changes are influencing the management of air traffic in Australia. The Chapter provides the background to the study and offers evidence for the need to better understand the role of learning in work practice in the aviation industry and in AirServices Australia. It traces the impact on AirServices Australia of national policy reforms aimed at assisting the national economy in an increasingly changing and uncertain world. The chapter concludes by outlining the organisation of training for accredited learning in the workplace.

4.1 Introduction

Successful organisations are never completely static. They are in continuous interaction with internal and external forces. For example, changing social, political and economic conditions, technological breakthroughs and changes in consumer demand, all act to initiate change. As discussed in Chapter One, high rates of change are particularly evident in workplaces characterised by High-3 work. A prime example of High-3 work is that found in the aviation industry.

The aim of this Chapter is to introduce the changes and challenges facing those working in the aviation industry, particularly within ATC and to provide the reader with an understanding of the kind of work air traffic controllers do. This Chapter:

- summarises the changes occurring within the aviation industry to demonstrate the ways in which the features identified in Chapter One are present within this industry sector;
- outlines the features of the organisation responsible for ATC work (AirServices Australia);
- introduces the kind of work activity performed by air traffic controllers; and
- summarises the preparation and training required to become an air traffic controller and to maintain ATC skills.

4.2 The aviation industry and growth in air traffic

Air travel began almost a century ago when a frail structure of metal, wood and fabric struggled into the air and carried a person 260 metres. Today the world is enveloped by a network of air routes and the air has become a highway for world commerce (ICAO 1994). The scheduled airlines of the world now carry more than one billion passengers and fly around 13,500 million kilometres per year (AVSTATS 1998).

Currently, world air transportation levels increase annually at a rate of 6.2 per cent, almost twice that of world Gross Domestic Product (GDP) (AVSTATS 1998). The Commonwealth Department of Transport forecasts that air traffic will double over the next 10 years, with projections to the year 2010 indicating that half of all international passengers (or nearly 400 million passengers) will be in the Asia-Pacific region (AVSTATS 1998). Although the Asian economic crisis can be expected to modify these predicted trends there is still a substantial amount of air traffic flow to and from Australia and within its boundaries. Australia has one of the highest growth rates for international air traffic in the world. International passenger traffic to and from Australia has grown by an average 8.3 per cent per year over the last ten years (AVSTATS 1998). During the year ending June 1997, there were 13.75 million international passenger trips into and out of Australia. Over the past decade, international air freight into and out of Australia has more than doubled. Approximately one quarter of the value of Australia's

overseas commodity trade is transported by air and (AUD) \$15.3 billion of Australia's exports (about 20 per cent of total exports by value) are air freighted out of the country. Australia's membership of the APEC forum and further movements towards liberalisation of markets are likely to add to the growth in air traffic. Domestic air travel has also increased, by 58 per cent between 1990 and 1997 (AVSTATS 1998).

4.2.1 Changing technologies and globalisation in aviation

The standardisation of operational practices for international services and the establishment of such standards all require coordinated international action. This is conducted by the International Civil Aviation Organisation (ICAO), a specialised agency of the United Nations. ICAO is an assembly of 182 countries who agree to adopt the International Standards and Recommended Practices and Procedures for Air Navigation Services developed by ICAO. In recognition of the unprecedented challenges facing member states and the civil aviation industry (created by traffic growth, emerging technologies, changing commercial and regulatory frameworks and increasing environmental concerns), ICAO has developed a strategic plan to guide air traffic management into the next century (ICAO 1994). Initially called the Future Air Navigation System (FANS), it is a plan to create a global Air Traffic Management system, supported by computer and satellite technologies.

As a result of work prepared by the FANS committee, the concept is now called "communications, navigation, surveillance/air traffic management", or CNS/ATM. The CNS/ATM systems concept has received the endorsement of ICAO Contracting States and approval by the ICAO Council and is now in its implementation phase. Under this system communication between air and ground crews will be via datalink or voice, both by satellite relay. Navigation will be performed by satellite-derived position information. Surveillance radar will remain in use although areas with no radar coverage will benefit from Automatic Dependent Surveillance (ADS), a function in which aircraft automatically transmit, via a datalink, data derived from on-board navigation systems (Ruitenbergh 1995). These technology-supported satellite systems will enable a global air traffic management system to be implemented for the first time.

Of concern is the impact these technological changes will have on the changing nature of work for those involved in air traffic, both in the air and on the ground. This has resulted in increasing attention being given to "human factors" related issues and to the role of the group or team in enhancing safety through processes of continuous inquiry (ICAO 1994; Helmreich, Merritt & Wilhelm 1998; Reason 1998; Westrum 1993). The International Federation of air traffic controllers argues that the introduction of CNS/ATM systems will change the very nature of the work of air traffic controllers and will constitute a change in the global air traffic system even more significant than the introduction of radar (Ruitenbergh 1996).

Australia is at the forefront of world change in managing air traffic following the 1994 decision to purchase The Australian Advanced Air Traffic System (TAAATS) from the French-based firm, Thomson Radar, at a cost of (AUD) \$272 million. This air traffic management system is to be supported by computer and satellite technologies and represents part of the CNS/ATM global air traffic management strategy. The transition to the new system in Australia commenced in 1998. Similar systems are proposed for countries involved in ICAO with the aim of implementing a global air traffic management system early in the next Century (ICAO 1994). In Australia, the new technology will mimic the existing technology currently in use in a transition phases to the new system which will include "ghosting" and "shadowing" periods of six to ten days per airspace sector over a two year period.

4.2.2 The importance of continuous inquiry in the aviation industry

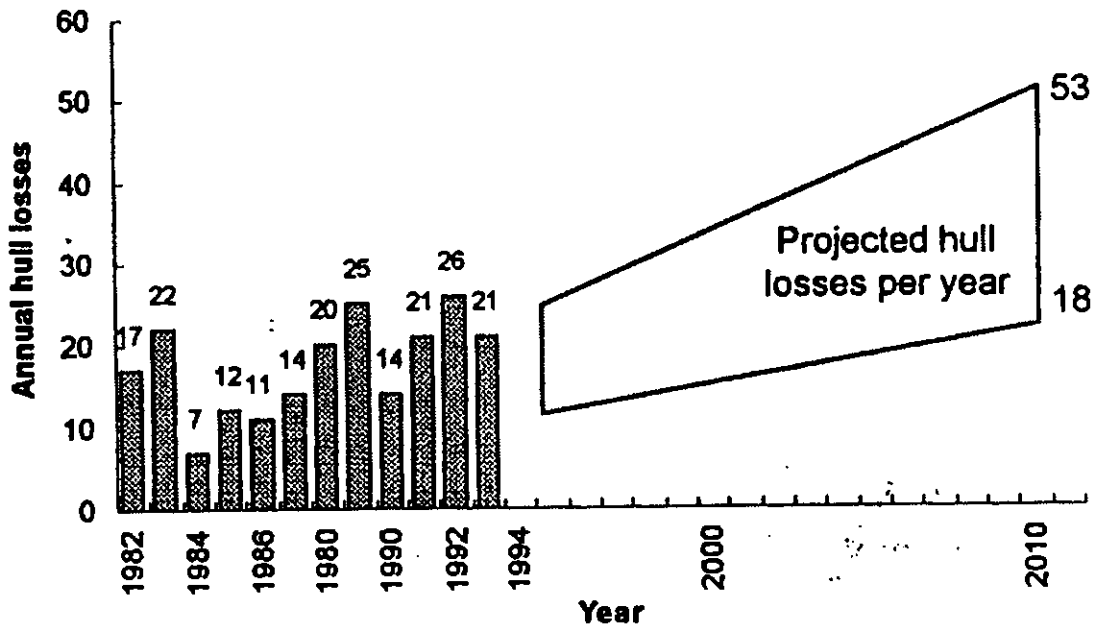
As discussed earlier in this Thesis, while changes in thinking about learning and work are reflective of a worldwide phenomenon, their importance to the aviation industry cannot be overstated. In this industry, performance and reliability are generally understood in terms of safety. Safety in aircraft performance has improved dramatically as a result of improvements to the technical and mechanical aspects of both aircraft and air-traffic management systems over the past few decades. Although flight is one of the safest forms of transportation available, Graeber (1996) pointed out that, given the estimated growth in air traffic over the next fifteen years, even if the fatality rate in commercial aviation stayed at the same level as it has done for the past ten years, the result could be a "major hull loss" (i.e., a loss of a full major airline carrier) every ten days (see Figure 2). Whilst air transportation is one of the safest forms of transport in the world, this potential accident rate is regarded as untenable for the flying public, commercial operators, and governments alike (Reason 1998; Rilatt 1994).

While technical and mechanical faults have declined as a source of errors and accidents, human errors have remained constant over time. As discussed in Chapter One, this means that between 60 per cent and 80 per cent of aviation accidents can be attributed to human error, most notably interpersonal communication failure (Hartel & Hartel 1995). Hence, enhancing communication, especially between individuals and groups is particularly important to those involved with this industry.

The role of communication between individuals and groups in supporting aviation safety has recently come under scrutiny. In the USA evidence of "team cognition", that is, where shared knowledge provides a basis for mutual expectations and interpretations that allow a team to function like a single cognitive unit" (Orasanu & Fischer 1992, p. 1), has been linked to enhanced performance and safety (Orasanu 1995; Prince & Stout 1995; Salas, Prince, Baker & Shrestha 1995). The aviation industry has attempted to enhance communication within teams by introducing and promoting "crew resource management" programs (Hawkins & Orlady 1993; Weiner, Kanki & Helmreich 1993). Crew resource management programs are aimed at

enhancing communication between individuals and groups to enable conscious inquiry to become part of everyday work activity.

Figure 2: Estimated air traffic growth and projected aviation accidents



Source: (Graeber 1996)

In ATC, human factors training (Hopkin 1995; Rilatt 1994; Wickens et al. 1997) and controller resource management programs (Ruitenberg 1995) also have been considered as strategies to cope with an increasing number of air traffic controller-related incidents of breaches of air safety. The implementation of teams within ATC, for example, was undertaken directly as a result of investigations into air safety in Australia (Ratner 1992), and this will be discussed in greater detail later in the Thesis. Unfortunately research into ATC human factors-related issues has been quite limited (e.g., Hopkin 1995; Wickens et al. 1997), and some research (at the time of writing) yet to be published (e.g., Issac & Ruitenberg 1999). The literature published to date has typically examined the human-machine interface and the impacts of technology on performance (e.g., Hopkin 1995; Wickens et al. 1997), overlooking the importance of learning and inquiry as a fundamental aspect of ATC work.

4.2.2.1 Mistakes in ATC work in Australia

In Australia, with increasing traffic has come a range of structural changes to work organisation and these will be discussed in more detail in Chapter Five. What is important to note here is that with these changes also have come an increasing number of “air safety incidents” or accidents.

An air safety incident occurs when standards of separation between aircraft are breached. A review of air safety in Australia conducted in 1992 (Ratner 1992) concluded that the increased incident rate (not to be confused with accident rates) could not simply be accounted for in terms of increases in traffic growth. Australia has had a series of reviews into air safety (BASI 1994a, 1994b, 1995, 1997; Ratner 1992) and yet Australia's incident rate has continued to climb. The incident rate per 100,000 hours flown has increased from 2.5 in 1985, to 4.0 in 1990 to 6.0 in 1996. Incidents are continuing to occur at this rate, that is, between 140-200 incidents per year (AVSTATS 1998). Of course, not all errors are detected and it has been suggested that the number detected might be as low as 30 per cent of the number actually occurring within any complex system (Reason 1998). The organisation responsible for air traffic control in Australia is AirServices Australia.

4.3 ATC in Australia

AirServices Australia has as its corporate mission: "to serve Australia and international aviation by pursuing high standards of aviation safety, through effective and efficient safety regulation and provision of world class aviation traffic services" (AirServices Australia Promotion Brochure 1995). The organisation comprises three operating divisions: (a) Air Traffic Services, (b) Rescue and Fire Fighting, and (c) Facilities Management. The focus in this Thesis is on the work air traffic controllers do within the Air Traffic Services Division of the organisation. In Chapter Five, the structural and cultural organisation of ATC work will be examined. At this point, an explanation of what work air traffic controllers undertake is provided to show the reader how the work characterises those features identified as important in future work in Chapter One.

4.3.1 The Practice of ATC work

Within Australia, there are approximately 1200 air traffic controllers, managing air traffic in and out of 29 regional, national and international airports. The goal of ATC work and the tasks of air traffic controllers are to maintain separation between aircraft in a way that is safe and allows for expeditious flow of air traffic. Air traffic controllers both direct the flow of traffic and provide in-flight information to assist aircrew in the operation of their aircraft (Manual of Air Traffic Services [MATS] 1995). The organisation of ATC work is divided into the phases of the flight (see Figure 3). The Figure illustrates how this division is shared between:

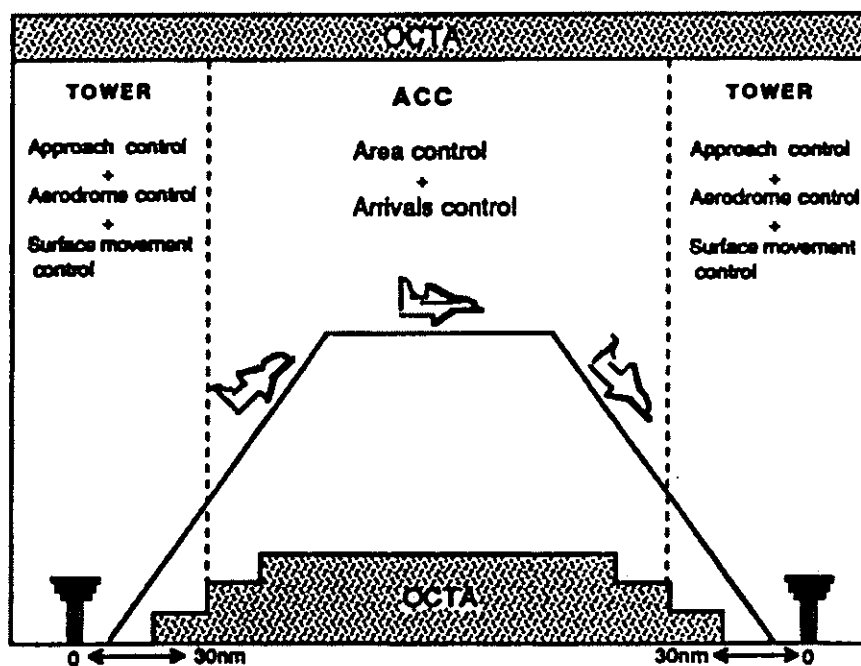
- the Tower, which provides airport control and surface movement control, and
- the Area Approach Control Centre (AACC), which provides Approach control (responsible for aircraft approaching and departing the airport), Area or "Enroute" control (aircraft travelling to and from their destination), and "Arrivals" control (preparing for landing).

The volume of airspace controlled by ATC in Australia, covers approximately 10 per cent of the world's surface, or 15.6 million square nautical miles (MacPhee 1992). In comparison, the US airspace covers 20 million square miles, and the Canadian 5.3 million. Like other countries, the

Australian airspace includes vast oceanic areas; however, unlike other countries, it also includes vast areas that are sparsely populated.

Although the controller is responsible for ensuring the safe conduct of the flight throughout that controller's airspace of responsibility, considerable collaboration occurs between the pilot and controller and with other controllers to ensure the traffic moves in a way that is orderly and expeditious. Controllers cooperate with pilots in an attempt to not inconvenience them with delays or by keeping aircraft at unnecessarily low altitude levels (and thus burning extra fuel), and so to assist pilots to achieve their desired flight plan and, where possible, to give them the most direct route appropriate to their flight plan.

Figure 3: Illustration of areas of responsibility for ATC work: Tower, Approach, Enroute and Arrivals

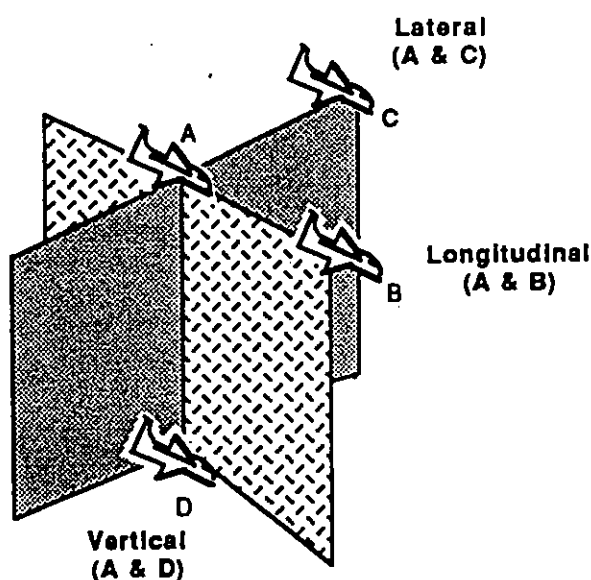


When regulating the flow of air traffic, air traffic controllers apply three standards of separation (see Figure 4).

1. Aircraft are vertically separated when they have a minimum distance of 1,000 feet between them;
2. Aircraft are laterally separated, when two aircraft are at the same flight level side by side and there is 1 nautical mile between them; and Aircraft are longitudinally separated when there is

20 nautical miles or 10 minutes between the aircraft in front and the aircraft behind (See Figure 4).

Figure 4: Standards of separation used in ATC



(Source: ASA)

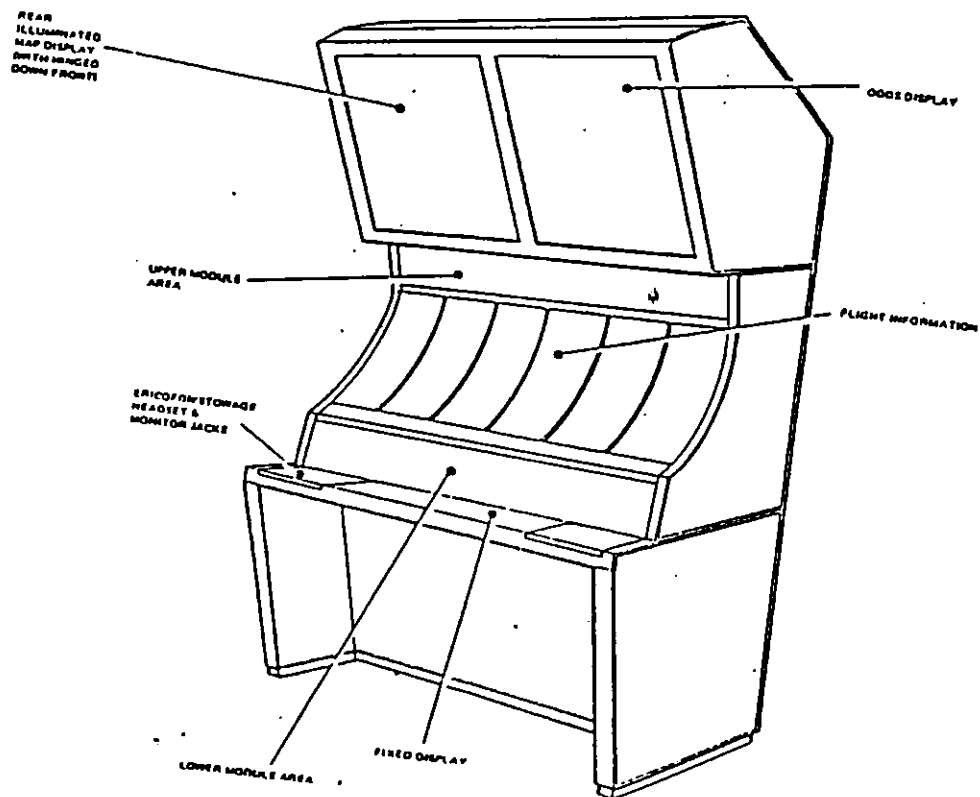
Even though ATC practice involves applying just three standards or rules of separation, the work is complex because of a range of other factors. For example, the weather influences the traffic flow. Aircraft may be required to divert from an original flight plan due to poor weather or, in a desire to get above or below poor weather conditions, aircraft may request flight level changes. Cross-winds or tail winds may alter an aircraft's performance resulting in the aircraft not performing as anticipated. Other environmental conditions (e.g., bushfires, fog) can also alter the flight plan.

The performance of each aircraft can also vary. There are currently 51 international, eight national, and 40 regional airlines, as well as 1,500-2,000 private aircraft operators flying in Australia (AVSTATS 1998). Each type of aircraft has its own "performance profile". Some go faster than others and the performance of the aircraft can vary depending on the altitude of the aircraft. Some perform sluggishly at low altitudes, others can climb quickly until reaching a certain level and then the performance changes. The performance profile of the aircraft is influenced also by factors such as: which company owns and maintains aircraft; how pilots

“drive” the aircraft; whether the aircraft has a full contingent of passengers; how much fuel the aircraft is carrying; and the duration of the flight from departure to its destination.

In undertaking the work, controllers use three main tools or instruments. First is the communications panel, where telephone and radio-telephone communications enable controllers to talk to pilots and controllers on other sectors. Second are the display mechanisms, which includes board displays of aircraft tracks, represented by paper strips and/or radar displays, also with bays and paper strips to record flight details of particular aircraft. When radar is available, the radar displays, shows a trail of “blips” or dots on the screen which represent a particular trajectory of a flight, with data alongside showing the flight number and flight level (altitude). The flight progress strips, which are strips of card approximately 20 cms x 2.5 cms, are divided into fields containing information for a particular flight (see Appendix 7). In Australia, radar is available for Enroute air traffic on the Eastern seaboard only and around each major airport.

Figure 5: An illustration of the layout of a console used in procedural air traffic control



When controllers use only flight strips to separate aircraft (in non-radar sectors), this is called “procedural separation”. Flight strips are used as an aid in both radar and procedural separation. Third are the map displays, which are used for spatial reference. Figure 5 provides an image of a typical procedural console where work involves paper-strip flight information and map displays.

From the flight information filed by the pilot or airline, the Airways Data System Operators (ADSO) staff have prepared the flight strips with certain information, including the aircraft’s call sign and planned flight path. This includes the estimated time of departure, the desired flight path, estimations of when the aircraft will reach certain geographical points and estimated time of arrival at the destination. The strips are arranged in racks and the racks in bays, above and below a fixed marker representing a particular navigation point. When a controller gives an instruction to a pilot, a mark is made on the flight progress strip summarising the instruction given (see Appendix 7). The flight strip is also used to summarise the planned and actual flight, providing details of the aircraft’s flight level, speed and estimated time of arrival at certain navigation points. To give the reader a sense of what is involved in ATC work, a typical domestic flight, along the eastern seaboard of Australia is provided in Appendix 8. A reading of this Appendix reveals that successful ATC depends on, not just traffic handling that is safe and orderly, but also on traffic that is handled as expeditiously as possible.

In summary, ATC work is mediated by technologies and involves a high level of responsibility and reliability and aims for 100 per cent accuracy. It involves multiple agents, higher order thinking (where the path of action is not fully specified in advance and yields multiple solutions), in a context of imperfect information, uncertainty and constantly changing conditions, time pressure and at times a strong sense of urgency. From this summary of work characteristics, it can be seen that ATC work illustrates the many features regarded as being important in future work (e.g., Castells 1997; James et al. 1997; Reich 1992) outlined in Chapter One. These aspects are indicated in Table 7.

Table 7: Changing characteristics of work and examples in ATC

CHARACTERISTIC OF FUTURE WORK	EXAMPLES IN ATC
Information service provision; interpretation of symbols	Controlling work involves interpreting the symbols available on the radar screen, the controllers annotations on the flight strip, as well as other symbolic data (e.g., meteorological information)
Use of complex technologies, computer-mediated work	ATC work involves use of radar, radio, satellite information mediated through computers

CHARACTERISTIC OF FUTURE WORK	EXAMPLES IN ATC
High levels of responsibility and sometimes high risk	The safety of all people on board all aircraft are the responsibility of the air traffic controller
Emphasis on 100 per cent quality	All aircraft that depart must have an expected chance of arriving safely
Multiple agents	Controllers work with other controllers, support staff (ADSOs) and flight crew to successfully achieve the task
Higher order thinking (e.g., the path of action is not fully specified in advance, not totally "visible"); yields multiple solutions	In modifying the flight path, there are often multiple decisions that can be made and remade as the traffic pattern unfolds
Imperfect information, uncertainty, changing conditions	The particular route can change for a variety of reasons include flight crew preferences, controller "style", changing external conditions - weather, aircraft profile, emergency
Time pressure and a strong sense of urgency	In some sectors, the time period from beginning to end of a task is 3 minutes

The above discussion provided an outline of the kind of work air traffic controller's do. The next section will outline the kind of training air traffic controllers are provided with so that they may be able to undertake their work.

4.3.2 Training for ATC work

The following describes the organisation of training as it was occurring during the data collection for the study. Training to obtain an initial licence (or "rating") to operate as an air traffic controller, is obtained following a variety of pathways, depending on the background of the person undertaking the training. Training to obtain subsequent ratings are also undertaken for a variety of reasons, including the policy changes associated with multi-tasking (the policies associated with making Australia a "clever country", as discussed in Chapter One and further detailed in Chapter Five).

4.3.2.1 Pre-service training

Training to obtain an initial rating to become an air traffic controller contains two main phases: (i) selection and College Training; and (ii) on-the-job training, which in turn contains a period of training using simulated airspace and a "final field training" phase.

Selection and training at the air traffic control college

Prospective trainees undertake a battery of tests, including spatial awareness and mathematics. Given the perceived benefits of being an air traffic controller (a starting salary of around (AUD) \$45,000 to \$50,000 per annum for someone who may be aged no more than 25 years old, there are generally many more candidates than places available. For example, in the 1995 selection phase, an estimated 3,000 candidates undertook the selection process and 90 were selected.

Selected candidates undertake pre-workplace training at the ATC Training College which involves lectures, simulated exercises and field placements. Trainee air traffic controllers learn the basic principles of air traffic management, which include techniques of separation, rules and procedures, aircraft profiles and meteorology. Since the 1950s, training for air traffic controllers had been conducted at the Organisation's Central Training College, known as Henty House, in Melbourne. At Henty House, initial training courses were either "long term" (two year) courses, for trainees without an aeronautical background, or "short term" (six month) courses for trainees with previous aviation training experience (e.g., conversion courses for air traffic controllers from overseas or from the military).

In 1989 a new approach to training of air traffic controllers resulted in the "Centre for Air Traffic Services" (CATS) being established at the (then) Tasmanian State Institute of Technology (TSIT). At the CATS, Launceston, the "long term" course was to be replaced by a formal award program entitled a Diploma of Applied Science. CATS accepted its first students in February 1989 and conducted five courses, each of two years study, staggered at six-month intervals, until the end of 1992. The CAA decided to suspend the *abinitio* (i.e., new recruit) training program at the end of the fifth course until after the completion of award restructuring-related conversion training to allow suitable Flight Service Officers (FSOs) and Airways Data Systems Officers (ADSOs) to upgrade their skills to perform the functions of air traffic controllers. The majority of these staff would have been otherwise redundant following a review of resources in 1991. In 1994, the partnership between the University of Tasmania (which had incorporated the TSIT in 1991) and the (then) Civil Aviation Authority was dissolved. The Authority established its own Colleges in Melbourne and Brisbane, taking *abinitio* trainees in 1995. According to the report "there appeared to be a perception that the program in Launceston was taking too long in placing air traffic controllers in operational centres" (ANAO 1993, p.14). Another report prepared within the organisation (ATC Training Review 1992) estimated the cost of training each successful student was \$154,000. When in 1995, the (then) Authority re-established responsibility for the training of *abinitio* controllers by opening its own Training College, the training time had been cut which, in turn, reduced the cost of training.

This history is important because, as it will be shown in Chapter Five and in later discussions of the findings, these differing selection procedures and the policies that accompanied them have set up opportunities for differing work cultures to be established and these have influenced workplace learning.

4.3.2.2 On-the-job training

Upon graduating from the College, the trainee is placed at the Centre within which they are expected to work. Here, they meet their team leader and members of the team and commence training on the air space they will work if they successfully complete their training. The first phase of training at that Centre occurs within a Training Annexe. This is a small training facility with simulation equipment. Here the trainee interacts with a simulation of the airspace of the sector they will eventually be working (in the College, trainees worked a “generic” airspace in simulation exercises). Annexe training occurs for approximately four to six weeks.

When trainees graduate from the College they begin their “final field training”. This consists of the time in the Annexe as well as time training on-the-job under the supervision of a licensed controller. The training and supervision continue until the trainee undergoes a “rating check”. The rating check consists of a team leader observing the work of an unsupervised trainee for a period of one to four shifts. A copy of the “check sheet” can be found at Appendix 9. This evaluation tool, with minor modifications, is also the one used in the Annexe and at the College. If the team leader is happy with the performance observed, the trainee is issued with an ATC licence, which is endorsed with the appropriate rating(s), and is then a “Journeyman” controller and a member of the team. The on-the-job training phase can last between eight and twelve weeks, depending on the complexity of the airspace and the progress of the trainee. An outline of the milestones for each week of the training can be found in Appendix 10 and summarised in Figure Six. The Figure shows how the training involves four broad phases: and orientation, core, rating and ongoing training. During the “core” and “rating” phase, first in the Annexe and then in the Area Approach Control Centre (AACC), the trainee is expected to achieve competency in the following areas:

- conflict recognition (to be able to recognise potential air traffic conflicts);
- separation assurance (to be able to identify options for separation that are safe and appropriate);
- traffic handling and workload management (the application of a logical work plan, including appropriate task prioritisation, decision making and implementation strategies, review and team-work);
- coordination (to be able to coordinate all traffic with others as appropriate);
- traffic planning (to be able to use all available data to anticipate appropriate actions required);
- radar technique (to correctly use radar to apply appropriate separation standards);
- SAR actions (to be able to conduct the appropriate action necessary for Search And Rescue);
- stripwork (to maintain accurate and legible writing and to use strips appropriately);
- phraseology and communication (to use appropriate phrases to communicate intended meaning);

- equipment handling (to be able to use all inter-console communication channels effectively); and
- airspace knowledge (to be able to demonstrate appropriate airspace knowledge). (See Appendix 10)

Details of assessment criteria for evaluating each competency are provided in Appendices 4 and 5. Reports on trainee progress are to be prepared at the end of each week of training by the instructor and discussed and signed by the instructor and the trainee. These are sighted by the team leader and the appropriate ATC manager. Assessment by the team leader during the on-the-job training phase occurs approximately two thirds through the training (called a progress check) and then again at the end of the training (called a rating check — see Figure 6). If the trainee fails the rating check, the training can be extended on the console or the trainee can be directed to return to the Training Annexe for remedial work, and to then recommence on-the-job training at a later stage. If the trainee fails this second attempt at gaining a rating, the training may be terminated, and if this is the case the trainee may apply to undergo the training once more after a period of generally six to twelve months. In some Centres (e.g., Melbourne) the team leader will have been involved in evaluating the trainee in the Training Annexe prior to the trainee entering the AACC. At the Southern District Office (Melbourne), this process has been formalised into a final field-training model (see Figure 6 for the overview of the model and Appendix 10 for a detailed description). Table 8 summarises the times taken through the main phases of training for an initial rating.

Table 8: Time for each phase of operational training for each pathway.

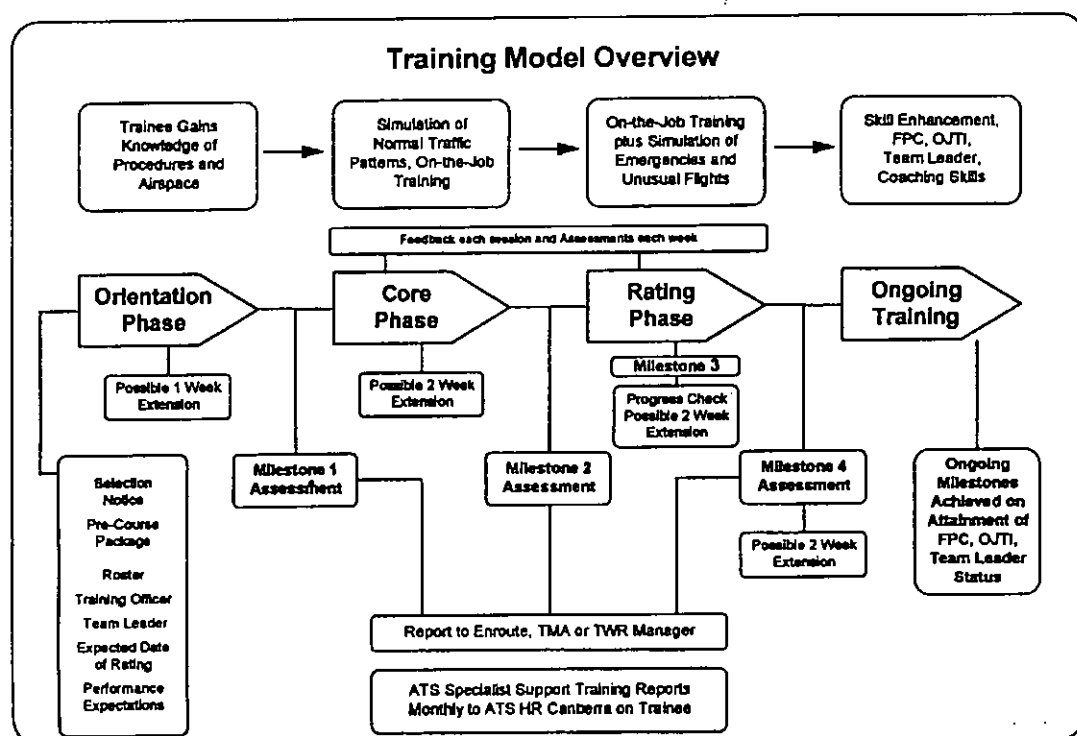
WHEN	PRE 1995	PRE 1995	POST 1995
Training phase	Long Term/ Uni Course	Short Term/ Conv Course	AirServices College
College/ University	104 weeks	26 weeks	32 weeks
Training Annexe	12 weeks	8 weeks	6-8 weeks
On-the-job training	12 weeks	12 weeks	10-12 weeks
Total	130 weeks	46 weeks	48-52 weeks

4.3.2.3 On-going training

If the controller is away from the console for a period of time (e.g., more than 14 days) then they are required to undergo a period of “re-familiarisation”. This involves working a shift under the supervision of a rated controller. In addition, the policies associated with multi-tasking adopted by ASA introduced a requirement that every rated controller was required to become a “Full Performance Controller” (known within the organisation as FPC), generally within three to five years of achieving an initial rating. To do this the controller must achieve a rating on three

airspace sectors and maintain “currency” (i.e., be up to date and therefore able to operate) on these sectors. The EBA decision to introduce the “Full Performance Controller” role also requires continued training, accreditation and re-training involving both Annexe Training and final field training.

Figure 6: Final Field Training Model - Southern District Office.



If a controller moves to another Centre, or decides to move into another stream of training (e.g., from Enroute to Tower or to Approach) then a similar retraining period is entered into, commencing in the Training Annexe. In summary, controllers can spend their entire careers moving from being a trainee, to being a rated controller (likely to include also a period of time operating as an instructor of others), and to becoming a trainee again (see Figure 7). Training to become an On-The-Job Training Instructor (OJTI) will be discussed below.

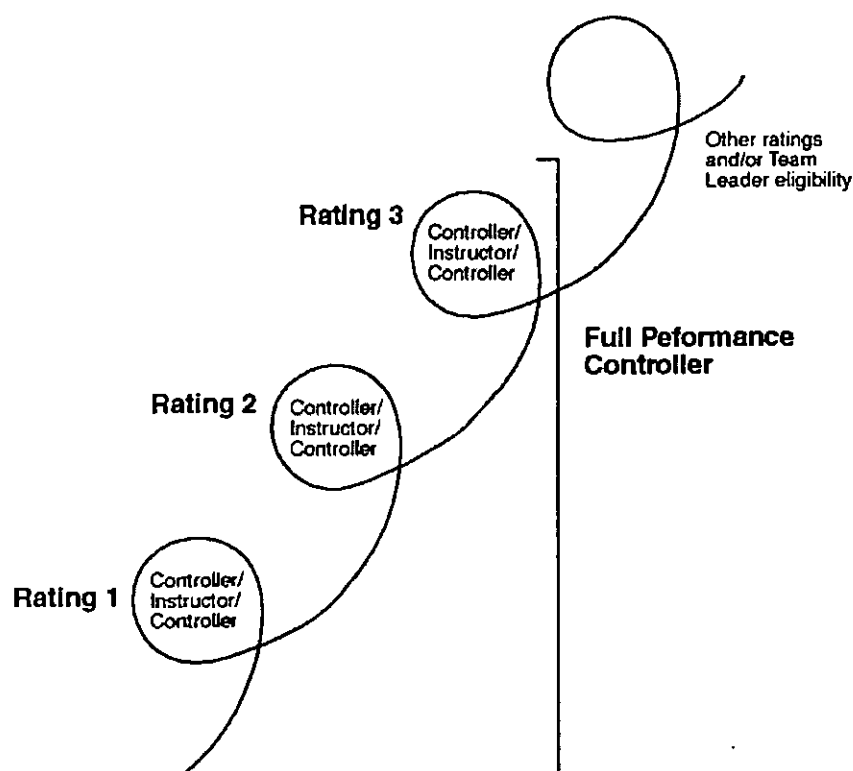
A Team leader, then, would typically be someone who is a full-performance controller and who has training capabilities. This would mean that they have proceeded through the cycle of trainee—controller/instructor at least three times (to achieve the required three concurrent ratings), before being able to take on Team leader training. Team leader training consists of a

four-day program examining issues which include leadership, group dynamics, appraisal, mentoring and coaching.

4 3 2 4 Training for instruction

To support this level of on-the-job-training requires development of OJTs. Six months following the achievement of a rating, the controller is able to become an on-the-job-instructor of others and this is now an expected part of the job (to be discussed in further detail in Chapter Five). This expectation highlights the importance of on-the-job training within the organisation, and its extensiveness. A number of internal reports (ATC Training Review 1992; CAQA Report 1993) noted that most training received by any ATC officer (*ab initio* or fully rated) is as a result of

Figure 7: The typical career path of a controller



training provided by other ATC officers at the College, an Annexe or through on-the-job training. Observing that the instruction provided has a major impact on the success of a trainee, the report concluded that Annexe staff and on-the-job training instructors were not always provided with sufficient training to enable them to successfully discharge their responsibilities (CAQA 1993).

The quality of ATC relies to a large extent upon the training system given to ATC's,

and, therefore, the quality of training is potentially a major "risk" to the provision of Air Traffic Services provided by the [then] CAA (Report *Evaluating the Flight Service Officer Conversion Course* 1993, p 1).

Another internal report, the "Review of ATC Training" (1992) also concluded that "literally no systematic development of [the] OJT [on-the-job-trainer] resource has been a major problem for *ab initio* and in-service training programs" (p. 19). Since 1993, Air Traffic Services Human Resources branch has invested substantially in providing on-the-job-training instruction (OJTI) for controllers to undertake this role. A national approach has been taken when developing a syllabus. Specific staff with educational expertise have been appointed and the OJTI training program has been reviewed (Owen 1996b).

The four-day training that on-the-job-training-instructors receive consists of basic instructional methods and material typically found in train-the-trainer programs operating in a range of other industry sectors, equivalent to what in Australia has been called a "Workplace Category One" Certificate. Content includes addressing aspects such as: the roles and responsibilities of the trainer, trainee and shift supervisor; adult learning principles; motivation; task/needs analysis; systematic on-the-job training: planning and preparation, briefing and de-briefing, observation and communication skills; questioning strategies; intervention strategies; and appraisal. The instructor training program emphasises "coaching" strategies which include negotiating learning goals, providing feedback to the trainee, using educational strategies such as questioning to facilitate learning and identifying ways of assessing if learning has occurred. It will be shown in Chapter Nine of this Thesis that the degree to which these strategies are accepted and adopted is mediated by the work group culture and existing norms of work practice, thereby influencing the ways in which accredited learning occurs within ATC.

In summary, this section has described the accredited training occurring within the organisation to acquire ATC skills. The organisation conducts a significant amount of training both on- and off-the-job. Training is conducted for new recruits and for staff undergoing conversion courses associated with award restructuring. Training is also occurring for regular maintaining and upgrading of skills and skill acquisition associated with the organisation's Enterprise Bargaining Agreement with its staff. Finally, training also occurs as a result of the changes in procedures and policies and as a result of other technological changes.

4.4 Conclusion

This Chapter has served to highlight the challenges facing those involved in aviation for domestic and international services. Air transportation plays a significant role in the Australian economy and in the well-being of its people. The pivotal role played by the aviation industry within current and future economic and social development in Australia is such that even small changes to the performance of key work activities, especially safety-related activities, will have a

significant impact. Australia's economic competitiveness relies on a safe and efficient air transportation system and this will become even more important in the future. There are huge demands being placed on the aviation system world wide, particularly in the Asia-Pacific Region and specifically within Australia. These changes are influenced by international and national policies, created by increased traffic growth and emerging technologies (ICAO 1994). In turn, these changes have also lead to modifications of organisational frameworks and changes to the organisation of work and these will be further discussed in Chapter Five.

An enormous amount of learning occurs within the workplace under study. This takes two forms: formal on-the-job training and informal learning embedded within work activity. The Chapter outlined the formal organisation of accredited learning. What this Thesis will show in coming chapters is that organisational structures and cultures play a key role in influencing the conduct and outcomes of such training endeavours. What are the features of these contextual elements in the ATC workplace? That will be the focus of the next Chapter.

Chapter 5

The structures and cultures of the ATC workplace

The contextual features of the ATC workplace are reviewed in this Chapter, thereby addressing the first research question: What structures and cultures can be identified within the workplace studied? The Chapter illustrates the ways in which internal structural changes associated with the formalisation and centralisation of work organisation, together with changes in the differentiation and integration of job tasks and roles have been introduced in response to changes in the external environment outlined in Chapters One and Two. The informal context of work organisation is also discussed and cultures of work practice are identified, based on different group memberships (e.g. identification with the occupational community; performance based on different tasks in the workplace). An analysis of the values and beliefs of air traffic control culture is also provided by examining the informal language used by controllers, together with the stories they tell. The Chapter concludes with a discussion of some of the “contested” cultures evident within the workplace.

5.1 Introduction

The last Chapter summarised the changes occurring in the aviation industry and introduced the organisation governing ATC work. Given the centrality of contexts in this Thesis, this Chapter will provide a brief review of the elements of context considered salient in the workplace under study and will use the themes identified in Chapter Two as a guide. Having reviewed the contextual features of the ATC workplace, it will then be possible in Chapter Six, to introduce a conceptual structure developed to account for the findings and to investigate the influence of these contextual elements on learning in the ATC workplace. The purpose of this Chapter is to address the research question:

- What structures and cultures can be identified within the workplace studied?

This Chapter:

- outlines the salient elements of structure in this workplace;
- examines the practice of ATC work and summarises the ways in which the work is physically organised; and
- examines key elements of the cultures in ATC.

Chapter Two outlined a number of salient elements from the literature that characterise an organisation's structure and these included: the degree of formalisation in work procedures and rules; the centralisation or distribution of power and authority throughout the organisation; and organisational complexity, including a variety of strategies to both differentiate between roles and tasks (divisions of labour) and also to integrate work activity. As will be outlined in this Chapter, all of these elements are evident in AirServices Australia and, as will be argued in later chapters, all have implications for learning in the workplace.

Air Traffic Services is a large complex bureaucratic-like structure, with its Head Office in Canberra, and offices located around the country. Most of the ATC staff employed are located in two District Offices (Melbourne and Brisbane). There is a high degree of formalisation in procedures and rules governing the work with centralised decision making, and the work is organised using both structures of differentiation and integration. The following section will outline the changes that have occurred within the organisation.

5.2 Changes to the organisation of ATC work

The internal structure of the organisation governing ATC work activity has been considerably modified as a result of the environmental challenges and changes outlined in Chapters One and Two. Like other organisations, AirServices Australia has undergone significant workplace reform

over the past few years. Historically, the organisation grew out of the Military (when civil aviation administration was a branch of the Defence Department). Between 1938 and 1988 the organisation changed names and the Departments it was associated with on three occasions. In 1988 it became the Civil Aviation Authority and in June 1990, the Civil Aviation Authority was made a Government Business Enterprise. In July 1995, a review of air safety resulted in the dissolving of the Civil Aviation Authority. Its functions were divided into two separate organisations: AirServices Australia and the Civil Aviation Safety Authority. This organisational restructuring had been the result of a number of air safety investigations into accidents where corruption and mishandling of air safety had been identified as major concerns. AirServices Australia currently has responsibility for ATC and the Civil Aviation Safety Authority has responsibility for air safety monitoring and accreditation. Understanding some of this history is important because, as suggested by activity theory, such history provides examples of “buds and contradictions” that enable and constrain development. These will be discussed further in later chapters where it will be shown that histories of practice, such as being associated with the military continue to influence learning in the workplace.

With the increased growth in international and national air traffic within Australia (see Chapter Four), has come pressure to conform with international standards and to be responsive to one of the organisation’s major stakeholders: the aviation industry. The initiative of the Australian Government in 1990 to change the organisation to a Government Business Enterprise (GBE), for example, was reflective of the Government’s micro-economic reform program requiring business enterprises like the Authority to derive most of their income from their stakeholders (i.e., the individuals and organisations making use of the service), rather than being reliant on the “public purse”. This led to a focus within the organisation on becoming more efficient and cost-effective by concentrating on core activities and reducing unnecessary overheads. The majority of the organisation’s current income (90%) is now derived from aircraft operations (AirServices Australia Annual Report 1996, p. 19). Other structural changes have been introduced into the organisation to reduce complexity in a changing environment.

5.2.1 Changes in the formalisation and centralisation of ATC work

Formalisation refers to the rules and procedures governing work activity and centralisation refers to the vertical distribution of authority, control and activity occurring within an organisation (see Chapter Two). In response to the changing environment and increasing demands placed on the air traffic system (see Chapter Four) structural changes have been introduced to reduce work complexity, through formalisation and centralisation, on two fronts: in the organisation’s relationship with its stakeholders and in the work activity undertaken within the organisation. First, because of the changing relationship between AirServices Australia (and its predecessors) with the aviation community, changes were introduced to simplify the formalised rules and procedures governing Australia’s airspace and to introduce an ATC system in line with international practices. As discussed in Chapter Four, ATC in Australia is governed by standards

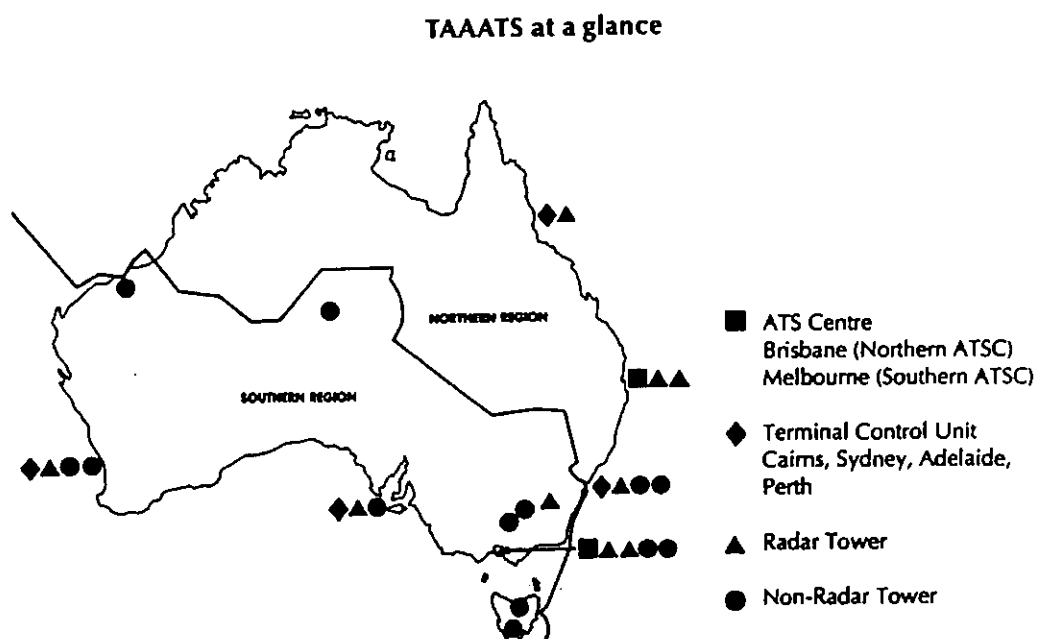
and procedures that have developed incrementally over a number of decades. The unique aspects of Australia, in terms of its size and its remoteness from other advanced aviation countries have led to procedures and practices which were different from international standards and practices set forth by the International Civil Aviation Organisation (Macphee 1992). This in turn had led to higher than usual operating costs and to higher acquisition costs for major capital investments because it was essential that developments suit the Australian environment, most notably, Australia's lack of radar coverage and the vast distances that needed to be covered (Macphee 1992).

Changes to reduce organisational complexity also have included the abolition of parts of the organisation — for example, a department called “flight operations”, where pilots and airlines previously lodged their flight plans. These kinds of changes were enabled by technological developments which allowed flight plans to be lodged electronically and the related tasks that used to accompany flight plan lodgement (e.g., checking the aircraft was loading the correct amount of fuel). Other changes included the proposed abolition of certain positions within Air Traffic Services, such as Flight Service Officers (see below). Changes in procedures also have reduced the job complexity involved in certain sectors of ATC. For example, at major airports (Brisbane, Sydney and Melbourne) a new traffic management procedure has been introduced called “STARS” (Standard Air Route Sequencing). The rules governing this procedure mean that aircraft are set up on formalised standard arrival routes for landing (that is the aircraft must be travelling at a certain speed and be at a certain height, by a certain geographical location) and these rules must be adhered to, reducing the flexibility that controllers once had over their work.

5.2.2 Changes to the centralisation of ATC work

When the organisation became a Government Business Enterprise, it needed to consolidate in order to cut costs and become more efficient. This led to the introduction of a strategy to centralise work activity to two Centres (for Northern and Southern Australia) at Brisbane and Melbourne (see Figure 8). This centralisation has been enabled by technological developments and policy decisions taken to reduce the ATC presence at major airports such as Cairns, Sydney, Adelaide, and Perth, to staff only controlling arrivals and departures at the airports of those sites. These terminal control units will be retained at each of the major airports until 2005, after which they too were planned for closure, with all traffic managed from two District Offices. The centralisation of ATC in two locations (Melbourne and Brisbane) has resulted also in the closure of seven “out-stations”, where air traffic controllers used to work at the airport Tower.

Figure 8: The two centre concept in operation: The area covered by the Southern region is controlled from the Melbourne ATC Centre



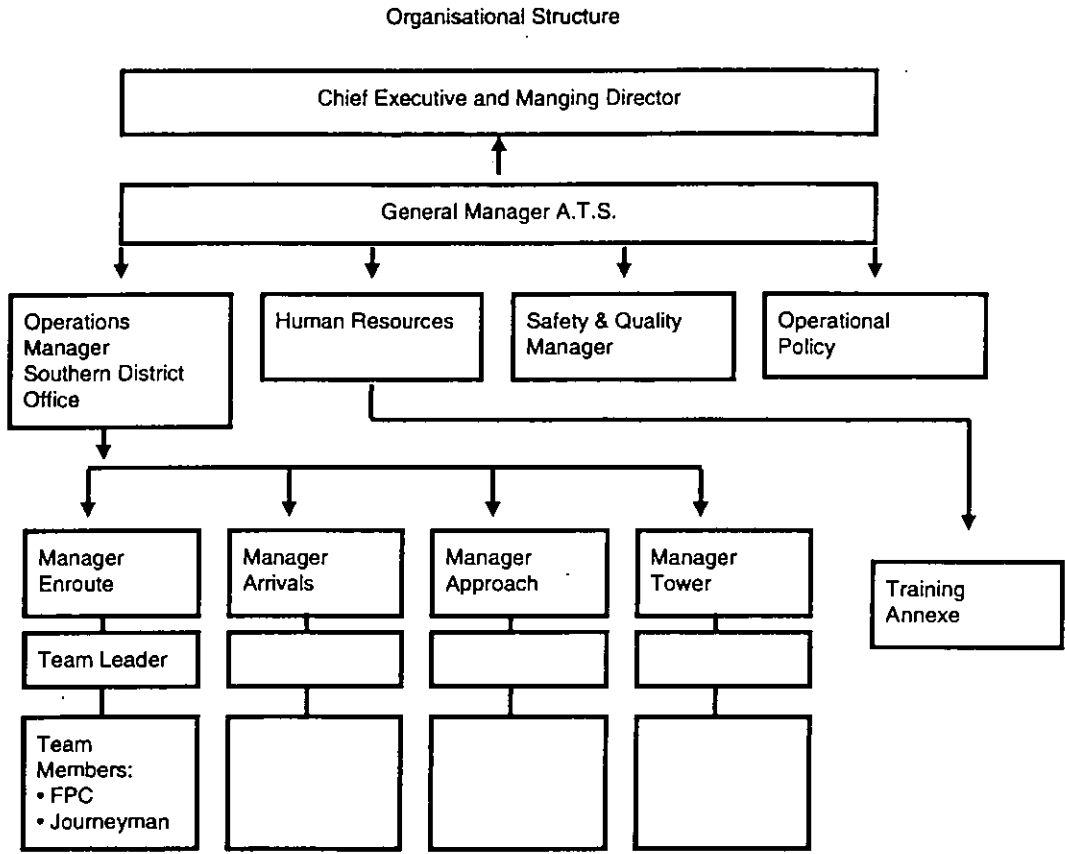
5.2.3 Changes in differentiation and integration of job roles and tasks

In large complex organisations such as AirServices Australia, jobs typically are highly specialised with finely differentiated divisions of labour and job roles. However, as was discussed in Chapter One, changing organisations also need flexibility. One way of achieving this nationally has been to develop and implement industrial relations policies (e.g., award restructuring) aimed at reducing job role differentiation by introducing multi-tasking. In AirServices Australia, for example, the implementation of industrial relations changes resulted in the restructuring of work practices by combining all operational staff into the one industrial agreement. This led to the abolition of certain positions within the workplace. For example, Flight Service Officers whose main task was to provide a traffic information service to pilots, which included weather and other related matters. This task subsequently was incorporated into the job tasks of air traffic controllers, with Flight Service Officers offered redundancies and the opportunity to retrain as air traffic controllers. The purpose of the industrial agreement was to provide “the basis for individual staff to make decisions about longer term career options as well as the flexibility to introduce new technology, new work practices and the transfer of functions between various groups of employees” (Civil Aviation Authority Annual Report 1994, p. 12). These industrial relations changes enabled further integration across job tasks and roles by introducing multi-tasking to the workforce.

Historically controllers, having achieved a licence to operate on one sector of airspace (called a “rating” — see Chapter Four), would move to other sectors when they felt like a change, a challenge or a promotion. As discussed in Chapter Four, multi-tasking initiatives, subsequently consolidated within the Enterprise Bargaining Agreement (EBA) led, in 1993, to the requirement that every rated controller become a “Full Performance Controller” where each controller was required to achieve and maintain currency on three airspace sectors. The EBA also contained another subtle, though important shift: the responsibility for instructing and training was now part of every controller’s job task once they had achieved an initial rating and had six months experience on the job. The criterion of “trainer-ability” was also added to criteria for advancement within the organisation.

The changes in job tasks and roles discussed above also enabled the organisational hierarchy to be flattened and work organised into teams. In the part of the organisation where this research was undertaken, work had been historically differentiated into seven hierarchical levels, commencing with a “Journeyman” controller (i.e., someone just qualified for the job) with six further hierarchical levels, linked to the progression through various air space sectors from Enroute, Arrivals, to Tower and Approach, and ultimately to the head of the Centre, the Senior Area Approach Control for the Centre (SAAC). Further hierarchical levels then continued throughout the organisation’s management to the CEO. In the organisation, this hierarchical structure was flattened (see Figure 9) so that within the Area Control Centre there are now only three levels (instead of seven): Journeyman controller, full-performance controller, and team-leader, before reaching the level of Manager. The “SAAC” had been replaced by a “CENCO” (Centre Coordinator) — a person responsible for the technical workings of the AACC but not responsible for personnel. Team leaders are accountable to the Manager of their particular stream of work activity (e.g., Enroute, Approach, Tower) and that manager is accountable to the Head of the District or Regional Office, who in turn is accountable to the ATS Manager in Head Office (see Figure 9). These changes have led to a decentralisation of decision making about everyday operations. However key decisions about organisational direction and work practice are still retained by staff at Head Office. The focus of this Thesis is on the work that occurs at the AACC and the linkage between this workplace and other parts of the organisation.

Figure 9: Components of AirServices Australia’s organisational structure relevant to this Thesis



5.2.3.1 Streams

In the past, controllers would work their way around the various airspace sectors, ultimately progressing through the organisational hierarchy. This resulted in controllers not achieving a rating on a particular sector such as Approach control until they had approximately 15 years of service. At the time this research was being undertaken a particular overseas work practice called “streaming” had been proposed and was about to be introduced. This practice would result in new trainees being directly recruited on to certain work “streams”, such as Approach, Tower or Enroute control, rather than Approach and Tower control being undertaken only after controllers had successfully worked their way through Enroute and Arrivals sectors (the functions of these sectors will be explained in more detail later in the Chapter).

5.2.3.1.1 Changes in the integrative mechanisms within the organisation of ATC work

Structures involved in integrating job tasks and roles include organisation into groups (such as teams or taskforces), and boundary spanning roles played by either individuals (e.g., a liaison role) or groups (such as a department). In ATC, team-work has been introduced since 1993. In

one of the major AACC Centres (Melbourne) teams have a member with the title “team training specialist” and it is this person’s role to liaise with the Training Department (the Training Annexe) to ensure the team’s training materials for new recruits are up to date. The Training Annexe also plays an integrative function, as it links other parts of the Human Resource Department’s function (such as the ATC training College) to the AACC. The details of the organisation of training for ATC was explained in detail in Chapter Four. In summary, the following structures of interest in this Thesis are presented in Table 9.

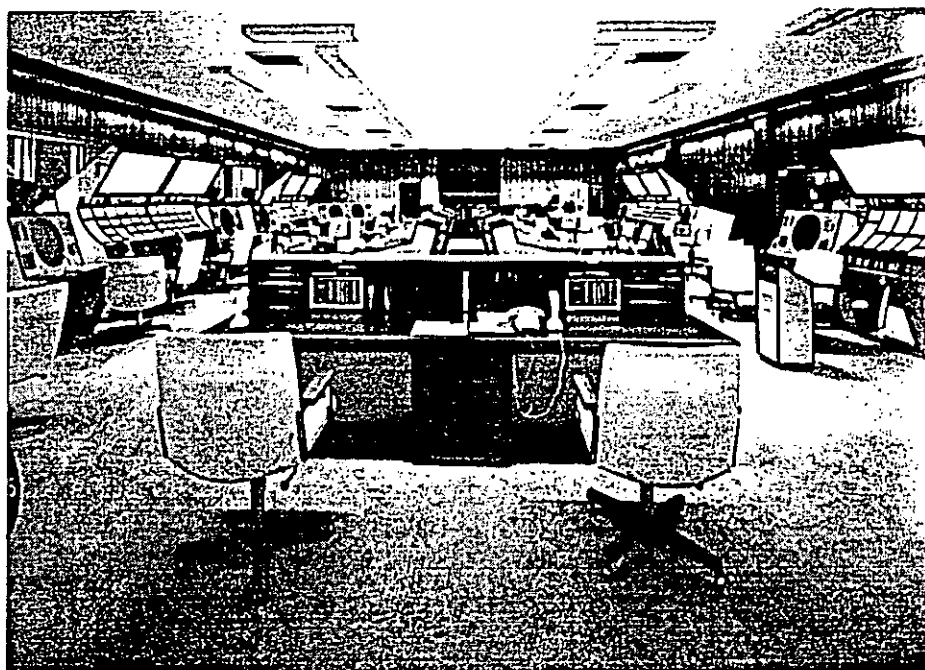
Table 9: Structural elements investigated in this Thesis

STRUCTURAL ELEMENTS	ATTRIBUTES	EXAMPLES IN ASA
Formalisation	Rules, procedures to achieve standardisation and conformity	STARS and related policies governing ATC work
Centralisation	Degree to which authority and control distributed within the organisation	Flattening of organisational hierarchy; Consolidation of work to two Centres
Complexity	Breadth of activities, strategies of differentiation and integration	Multiskilling of job tasks and role (EBA); team-work; liaison roles, Integrating functions (e.g., org of training)
Physical organisation	Physical organisation of the work-space and its activity, (e.g., its architecture)	The place called The Room; Technologies employed in the work

The final structural element presented in Table 9— the physical organisation of the work-space and its activity — will now be outlined to demonstrate how physical work organisation and the technologies employed in the work structure and shape work activity.

5.2.4 The physical structuring of work activity

As indicated in Chapter Two, structures of work organisation also can include the physical layout governing work activity. To complete this review of structure, the layout of ATC work will be outlined. A typical layout of ATC operations is presented in Figure 10. The existing work configuration for The Room is displayed in Figure 11.

Figure 10: The type of configuration used typically in ATC operations

5.2.4.1 The place called The Room

The work of ATC for the Southern District of Australia occurs from a place called “The Room”. Figure 11 presents a schematic representation of the work-spaces of The Room for the Melbourne AACC. The configuration of ATC consoles within The Room (represented in Figure 11) reflect the organisation of airspace sectors across Australia (the geographical location of the airspace of each of the consoles is presented in Figure 12 and will be discussed shortly). In the middle of The Room stand data preparation units where ADSO staff prepare flight progress strips for use in tracking the proposed flight plans logged by airlines and private pilots. The clatter of the plastic strip holders punctuates the hum of controllers talking with pilots and other controllers. Adjacent to the room (not shown in the diagram) are refreshment facilities, locker space and a recreation area. As can be seen from Figure 11, banks of consoles flank three and one-half walls. As indicated by the layout of the Figure, those working the consoles have their backs to the middle of The Room. Lighting is subdued to allow easy reading of data on radar consoles. The current set of radar screens are monochrome providing for dull green “paints” (i.e., radar information of aircraft) on a darkened background.

Along the left hand wall of The Room (see again Figure 11) are the sectors closest to the airport: Approach/Departures, Arrivals and the “flow” controller (listed, for example, on the diagram as “ML Flow” and “ML App E”, meaning Melbourne Approach East). On the opposite side of The Room are the Enroute (radar and procedural) sectors, covering the airspace in the middle of Australia (listed as Sectors One, and Five, together with Sectors Four and Six. At the end of The

Room, linking the left and the right walls are a mix of radar sectors associated with air traffic along the eastern seaboard of Australia. To aid interpretation included in Figure 11 and Figure 12 are some examples of the flow of communication within The Room and beyond it as two typical domestic flights traverse the airspace (e.g., a flight from Melbourne to Brisbane and Melbourne to Sydney). The typical flight, outlined in Appendix 8 for example, is likely to have traversed through the sectors represented on these Figures.

The flight described in Appendix 8, and the information flow included in the Figures, illustrates the interdependence of the operation of ATC work across sectors. Outward bound flights emanate from the Approach sectors (in collaboration with controllers in the Tower outside The Room) and then aircraft are handed off (i.e., transferred) to controllers operating other consoles situated across The Room. Air traffic controllers might be working in concert with others in the same room, or at other Centres (e.g., Adelaide, Brisbane, Sydney, Perth) or in another country. Controllers might also hand-off control of a flight to military air traffic controllers operating military airspace within Australia. Military airspace is generally active only during RAAF exercises and thus may be active only temporarily. Inward bound flights reverse the trajectory of information flow across The Room by travelling from the Enroute sectors, through “inner” Arrivals and onto Approach, with the work mediated by the “flow” controller (a senior controller, who assesses the overall traffic flow and decides the Arrivals sequence and conveys this information to the relevant Enroute and Arrivals controller).

Appendix 8 illustrates the ways in which air traffic controllers work interdependently and also how they facilitate collaboration from others such as pilots to achieve a successful outcome. The flight described also shows how busy the work gets and how one person’s work impacts on others, including if one controller wants to speed up or slow down the pace of the work. The demands of the work will also vary depending on the kind of sector involved. A summary of the time-frames of airspace sectors is provided in Table 10. It can be seen that the closer the sector is to the airport, the less time the aircraft spends in the sector. However, because of the factors identified in Chapter Four (e.g., aircraft profiles and weather conditions) all sectors can be busy depending on the various problems presented.

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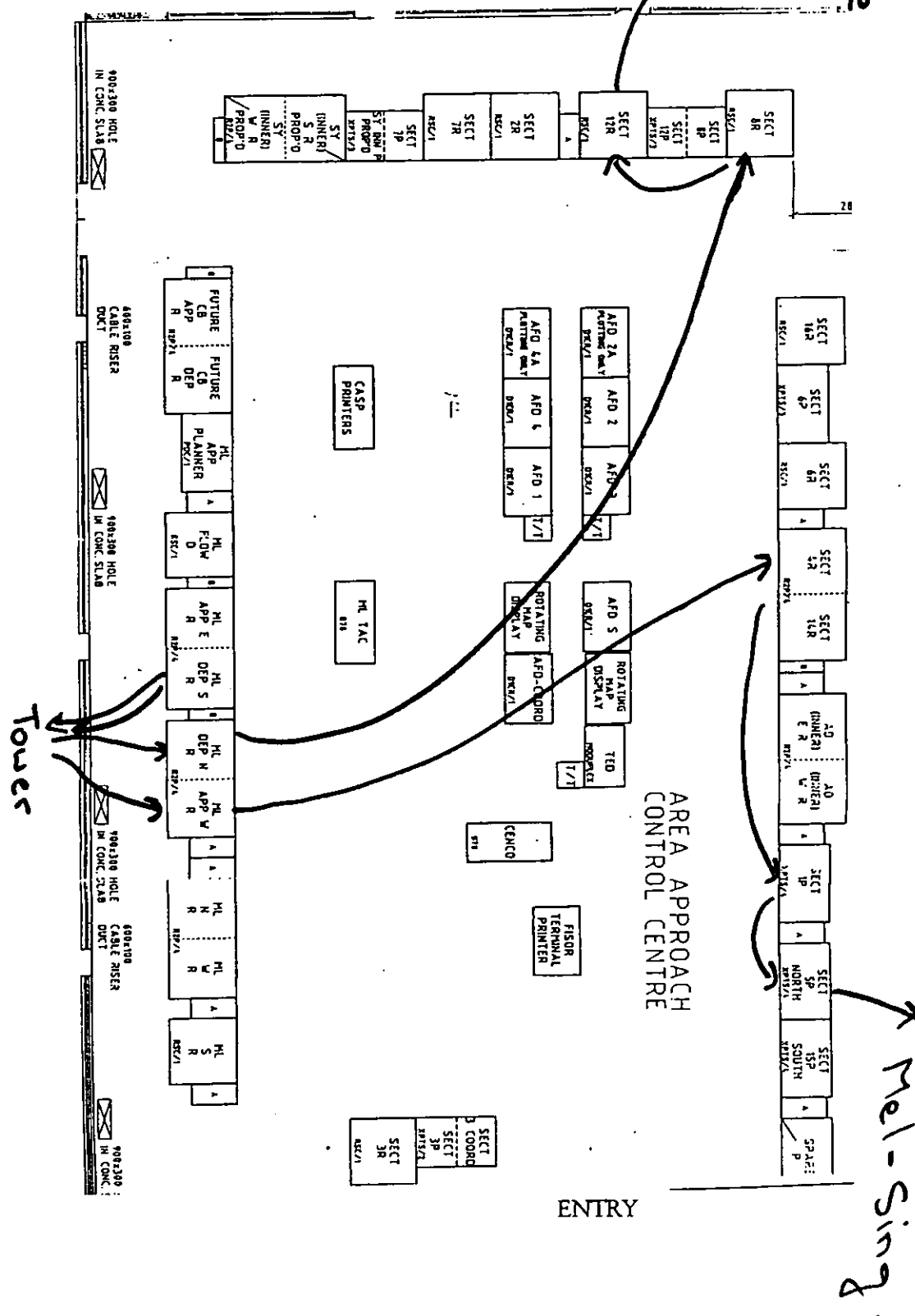


Table 10: Summary of time frame for airspace sectors.

AIRSPACE (IN ORDER OF DISTANCE FROM AIRPORT)	TIME FRAME OF AIRCRAFT IN SECTOR (AV)
Tower	2-4 min
Approach	5-6 min
Arrivals	7-10 min
Enroute	15 min-2 hours

This section commenced with an overview of the organisational structure of AirServices Australia, and identified a number of structural changes that have been introduced in the past few years to enable the organisation to better respond to its environment.

5.3 Cultures within ATC work

The Chapter thus far has discussed various structural contextual elements evident in ATC work practice. The balance of the Chapter will discuss those contextual elements that are cultural in practice. As discussed in Chapter Two, attending to organisational culture is important in this Thesis because if “context matters”, then organisational cultures will influence accredited and informal learning in important ways. An analysis of organisational cultures, then, will yield important insights into collectively held beliefs, values, history and experience of workplace learning and change, and the common context that links individuals to groups. Understanding something of a group’s “culture” will offer some insight into what that group has learned (and what it has not); what it regards as important (and what is not); and what is regarded as learnable (and what is not) (Owen & Williamson 1994). A ‘group’ is here defined as:

a collection of individuals (1) who have significantly interdependent relations with each other, (2) who perceive themselves as a group, reliably distinguishing members from non-members, (3) whose group identity is recognized by non-members, (4) who, as group members acting alone or in concert, have significantly interdependent relations with other groups, and (5) whose roles in the group are, therefore, a function of expectations from themselves, from other group members and from non-members (Hartley 1996, p. 401).

This definition highlights the structural features of groups (e.g., their interdependence) and alludes to the cultural features that give a group its identity (e.g., the norms of behaviour

expected). Examining evidence of organisational culture also provides insight into the way practices are embedded in organisational structures because it highlights the relationships and interdependencies between groups and the types of accounting systems that individuals and groups use to explain their actions.

As discussed in Chapter Two, cultures are demonstrated in the way people communicate understanding, their shared norms of behaving; the stories they tell; and the stereotypes they use to account for group membership. In this respect groups become, as Louis (1986) suggests, “culture bearing milieus”.

It will be argued in Chapters Eight and Nine that opportunities for the development of specific work group identities are shaped by structural features of work organisation, such as that determined by the divisions of labour and rules of accountability and authority. This is because structural features concentrate workplace experiences in certain groups and lead to socialisation through enculturation into established ways of acting. As stated in Chapter Two, culture plays a particularly important role in organisations, especially High-3 ones, not only because it can enhance an organisation’s capacity to learn from mistakes by enabling group understanding of shared meanings but also because it standardises behaviour. This is because shared values and beliefs allow individuals to conceptualise issues in a standard way that is shared through group norms of behaviour. According to Wheelan (1994) “agreement about values, norms, and ideologies reduces member anxiety and increases the ability to predict and understand the events that occur” (p. 27). However, these norms of behaviour can also exert conformity and, hence, deter learning (Hendry 1996) because they focus attention on valuing certain kinds of behaviours and not others and can also inhibit the questioning of those behaviours.

5.3.1 Elements of culture in ATC work

In this section the ways in which individuals in ATC engage in workplace cultures will be outlined and some of the salient elements are summarised in Table 11. The discussion will commence by reviewing aspects of group membership, which include gender-related groups, broad occupational groups and groups based on tasks and roles undertaken. This will be followed by a discussion of communication patterns and norms of behaviour. Some of the collectively held beliefs and values within ATC will be discussed and these will be demonstrated by reviewing the kind of language air traffic controllers use when describing their work. Finally a comparison of some of the norms of behaviour within ATC groups will be outlined. Collectively held values and beliefs are shared also through narrative as “war stories”. Group norms provide the foundations for the development of stereotypes of behaviour and also become used in language to portray archetypes of behaviour (known as “Gun Controllers and “Adrenalin Junkies”). It will be argued later in the Chapter, that different experiences of work groups are leading to different norms and these have implications for practices of inquiry and thus learning, identified in this Thesis as those associate with individuals acting as “Lone Rangers” and others

acting as “Team players”. The following aspects of culture are of particular importance to this Thesis.

Table 11: Aspects of workplace cultures important to this Thesis

CULTURAL ELEMENTS	ATTRIBUTES	EXAMPLES IN ATC
Group membership	Language and symbols used to justify membership and non-membership to particular group(s)	Groups: gender; professional affiliation, work groups: operational and non-operational groups, airspace sector groups
Communication patterns	<ul style="list-style-type: none"> • Collectively held beliefs and values that members share • Informal language used, stories shared, (real and imagined) 	Importance of ability, performance and confidence Stories based on actual practice — “war stories”, mythological archetypes “Gun Controllers and Adrenalin Junkies”
Norms of behaviour	Expected ways of behaving	Justifying work in terms of one’s performance; putting others down; “Lone Rangers” and “Team players”

The rest of the Chapter will elaborate on the kinds of workplace cultures evident in ATC.

5.3.2 Group memberships

As in most organisations, people in ATC belong to multiple groups. Some of these groups are work related and some are not. Some groups are external to the organisation, others are within the organisation. When individuals define themselves as part of a group, they justify their behaviour in terms of group norms and develop a group identity in terms of their interactions with others in the group and the responses of others to group behaviour (Fine 1996). For example, individuals identify with their occupational group. An occupational identity occurs, for example, when workers justify the work undertaken by their work group and explain to themselves and others why what they do is admirable and or necessary.

Some individuals identify with groups that may or may not involve other members of the occupation. For example, some male controllers (and as at 1997, 93 per cent of all Australian controllers were male, and mostly of anglo-celtic descent) identify with their gender, their masculinity. Masculinist group cultures have been researched within a number of occupations, such as automotive, metal fabrication, engineering and computing (see Cheng 1996; Collinson 1992; Messerschmidt 1996). The following controller discusses the ways in which masculinist group cultures would be displayed in The Room.

I: We were talking about the culture of air traffic control.

R: About air traffic in general. I think if you talked about teams — it's very ego driven. The term 'anti-woman' isn't right. Air traffic controllers respect someone who can do the job and that doesn't matter what the sex is, but a lot of them are very much like this group of people where they'll happily have a go at someone and use the feminine joke.

I: What? Like '*you're such a girl*'?

R: Yeah. I think nowadays the majority of them don't mean it, but there's still that culture, there's still a very ego driven culture (Int. 36, TOI, Northern District Office).

For this controller the term "very ego-driven" infers a culture that is male-ego driven, as evidenced by the gender-based comments that accompany the explanation. The "feminine joke", in this instance, is a derisive term and is an indicator of masculinist culture. As will be shown later in this Chapter and in Chapter Nine, those identifying with masculinity tend to emphasise behaviours associated with performance and perseverance, with "individualism" and being "tough" and these collectively held beliefs inhibit inquiry and, hence, learning. Controllers may identify also with groups external to the organisation that have nothing to do with work activity, and as such may seek little involvement in work activities beyond what they are required to do. However, many controllers not only identify with their occupation but also with others in similar occupations within the aviation industry.

5.3.2.1 Professional affiliation with the aviation industry

There are controllers who have a strong association with the aviation community and define themselves in terms of this affiliation. These controllers may either own an aircraft or at least operate as a pilot in their spare time and value knowledge about aircraft types and aircraft performance. Controllers identifying with the aviation community are likely to have a strong service orientation to pilots, since they have experience in being on "the other side". The following quotation illustrates the "love of aircraft" spoken of by controllers identifying with the aviation community.

From ever since I was a little boy I lived next to an aerodrome, Essendon Aerodrome just over here, and I've always had a fascination for aeroplanes, and all through my youth I went to air shows and hung over fences and was always fascinated by aeroplanes. When I commenced work, my very first pay that I got I started to learn to fly — at the age of 16. At the age of 16 I got a pilot's licence and I was working at Essendon Airport with the Department of Customs and Excise, to be near aeroplanes, to have an involvement with aeroplanes. But I felt that when I finished school, the qualifications that I had, would not get me into the airlines or the Air Force. I was thinking along those lines. When I started work my first thing that I wanted to do was to learn to fly, so I did that and I got my licence. And then it seemed strange coming to Essendon Airport flying across Melbourne as a 16 year old to collect my pay. I couldn't drive a car, because

[you had] to be 18. But it was very clear from after about a year in Customs that really wasn't what I was interested in. It was more a clerical type job. And I saw an ad in the paper one day for ATC [and I applied and got it] (Int. 35, TOI, Southern District Office).

Controllers also identify themselves with others who have similar histories of experience within an aviation-related occupation. For example, when conducting the research, the controllers would be asked to describe their background. They would typically commence with a shorthand description which outlined the kind of training they had undertaken (e.g., "I did a short course at Henty House" or "I came off Utol CC Course 4"). This information provides the listener with immediate information about the history of the speaker: the level of aviation background the person has had, their historical positioning within the organisational system and the aviation community more generally. If the speaker described having undertaken a "long" course, for example, then they had no previous aviation experience or background of note, whereas a "short" course indicated the speaker was likely to be either a pilot or to have had experience in the military. Controllers describing "CC" course, or Conversion Course (and the number) would indicate the speaker was previously in either Flight Service or Airways Data operations, and had undertaken the training to upgrade to an ATC position. Although the situation has now changed, individuals would be offered a course in order of their ranking from the selection tests. Thus participants in "Course 1" had received better selection scores than those in "Course 4".

5.3.2.2 Workgroup identification

The segmentation of tasks and sub tasks and the meaning and values controllers place on undertaking these tasks result in controllers identifying with a number of groups within the work activity of ATC. These groups are defined by whether people are licensed to work in The Room (or not) and what kind of work they do (e.g., which sector), at which Centre they work in, and their background in relation to aviation and the organisation. In undertaking this research a number of sub-groups within the workplace were identified (through observations and interviews) and these included: operational and non-operational work groups, work groups based on different types of operational work within ATC, and between those operating different sectors. These are outlined in Table 12.

Table 12: Summary of work group cultures evident in the study

WORK GROUP CULTURES	EXAMPLES
Operational/ Non-operational work	Those licensed to work in "The Room" and those who are not (e.g., Tr Annexe)
Between different types operational work types	Flight Service Officers/ Air traffic controllers
Within different types of operational work	Approach/ Enroute controllers

5.3.2.3 Operational and non-operational work groups

Within ATC, one of the ways in which groups define themselves is based on the work those groups perform within the organisation. One distinction that defines the kind of work undertaken is whether it is regarded as “operational” or “non-operational”. Operational work within ATC is work that involves the task of separating aeroplanes, whereas non-operational work involves any other work. Operational work is defined by organisational members as that performed in a “real time”, dynamic, environment. Air traffic controllers differentiate their work from that found in other parts of AirServices Australia (or indeed in other organisations), based on the notion that their work cannot be stopped, once it commences. Air traffic controllers define themselves as different from other “non-operational staff” because they are the ones who “earn the money”, they define themselves as being at the “sharp end” of the organisation. In the following transcript, for example, the controller is talking about a lack of respect controllers have for non-operational staff, in part because those staff do not seem to appreciate the work controllers perform.

People [ATCs] wouldn't necessarily have respect for managers that came in from outside because there is a perception that you have got to understand the job. [A CEO had] the insensitivity of saying, back like a few Christmases ago, wishing everyone a *'Happy Christmas and a nice break away'*. Most of the employees and the money earners for the [then] CAA are shift workers who would be working over the Christmas period. [I: *That's one of the busiest periods for you.*]. Exactly! Here was he wishing ... he's talking about the admin staff, the people who don't earn the money, if you want to get down to it (Int. 69, Trainee, Approach, Brisbane).

The operational/ non-operational divide was also evident between those rated controllers in The Room and those (often unrated) ex-controllers who work in the Annexe who now have full-time training roles. Historically, the Training Annexe has been variously been called “club vege”, “God's waiting room” and “the Rest Home for the invalid”. These labels portray the value that rated controllers place on undertaking the work of ATC. Those who cannot undertake the work because they do not have a rating are of limited value (best encapsulated by the saying “those who can — do; and those who can't — teach”). In the following transcript, the non-rated ex-controller explains the perception he believes rated controllers have of the work he and his peers do in the Training Annexe.

It's part of that dilemma. If *'we're the people - we're the people delivering the job'*, [then] *'the rest of you are all parasites. Including all you training people'*/ Our fellow controllers say, *'Having a jolly down at [the College]? You people in the Annexe. You aren't really separating aeroplanes. You're getting money for nothing.'*/ it's the old thing about, *'if you can't do it — train'*. Alright? It's

right in there, right? And everybody believes it. I suspect I even believe it. You know what I mean? (Int. 20, Instructor, Training Annexe, location with-held).

In the quote above, it is evident that controllers define themselves by the kind of work they do and one of the first means by which that is defined is if the work is “operational” or “non-operational”. Operational work is more highly valued than work performed by those who are not licensed to operate within The Room.

5.3.2.4 Controllers and other operational staff

Within The Room, historically, there were two kinds of operational work performed (ATC and flight service information) and both required licensing or ratings for individuals to be able to do the work. The two streams had their own training, rating procedures and, up until the changes in IR policy leading to award restructuring, staff rarely “crossed the line” between the two occupations. Within these two aspects of operational work (e.g., ATC, flight service), there have been divisions that have deep historical roots. These divisions created sub-groups based on the kind of work undertaken and, as the next transcript shows, extended to how each group entered, for example a building at a particular Centre and where they parked their cars.

It has always been an ‘us and them’ mentality, particularly in large Centres where there is a physical division between the areas. I will give you an example, in Brisbane, Flight Service was one end of the hall, ATC was the other end of the hall there was a wall between us. We all opened on to the same hallway but it was physically at the stage where Flight Service Officers would use one entrance to the building and ATC would use the other entrance to the building and didn't talk to each other in the car park, didn't know each other personally (Int. 33, Instructor, ATC College, Melbourne).

According to the above respondent, in this particular Centre, when the wall physically separating the two groups was removed, each group acted like “fish in a bowl”, each working within their own space up to close to where the wall once was but remaining within their own “territory”. The formal division of labour between ATC and flight service changed with the commencement of organisational downsizing, supported by policies of award restructuring and technological development (see earlier Chapters One and Two). The historical divide between the two groups, however, had set up a background of anxiety and suspicion for some, when organisational restructuring resulted in the abolition of flight service positions whose occupants were then offered the opportunity to train as air traffic controllers. As the respondent documented in the transcript above continues, flight service officers were believed to perceive that there was an underlying political agenda behind the offers of re-training made when the flight service position became redundant.

Well it's — getting back to the attitude of some — some come in [to do the conversion course] with the attitude that ‘This is just a circuitous route for the [organisation] and a

bunch of air traffic controllers to get rid of us / because they don't want us anyway, getting rid of our job and [they] can't just get rid of us with involuntary redundancies without offering us this chance [to do ATC conversion training] and they are going to make it as hard as possible for me (Int. 33, Instructor, ATC College, Melbourne).

This animosity, suspicion and concern was reported in all centres, but not by all staff. Some staff who had undertaken and successfully completed the conversion course believed that the animosity was history — part of an old culture and that it no longer existed. As the following ex-Flight Service Officer, now controller, explains:

I know I came from that - the old school in Flight Service was that ATC is that Out There and we were very much 'us' and 'them'. And so you start out your training program with the feeling that perhaps you're not wanted. So that's one of the major things that I'm interested in - is to make sure that that kind of barrier is broken down. And I've quickly discovered that it doesn't exist — that they're all just human beings and they've actually got a really good attitude towards training (Int. 48, Controller, Enroute, Melbourne).

Those who did believe that flight service officers were being integrated successfully into ATC positions were generally younger and had fewer years of experience in the organisation. Just as there were divisions between the kind of operational work performed, so too were divisions identified within ATC work undertaken in The Room (or equivalent - i.e., Tower work) based on the type of airspace sector.

5.3.2.5 Prima donnas and sector wogs: Approach and the rest of The Room

Earlier in this chapter the various ATC sectors and their structured work relationships to one another were outlined. This arrangement results, at the Melbourne ATC Centre, for example, in Enroute sectors being on one side of The Room, and Approach being on the other (see again Figure 11). This physical separation provides a foundation for the development of sub-cultures within The Room based on work activity and is further developed in the physical location of work groups (where Approach controllers are sometimes labelled "prima donnas" and Enroute controllers "sector wogs"). As will be discussed in Chapter Nine, within-ATC beliefs and values about ability, performance and confidence set up sub-groups based around the kind of work undertaken and these beliefs both enable and constrain learning. In the following extract, an Arrivals controller describes his work and how Approach controllers (those traditionally perceived to have the most ability and to work at the highest level of performance) would traditionally behave.

I: People have talked to me about the differences in ATC culture and some of it is really strong and people have talked about '*There is an Approach culture and there is a rest of the room type culture*'. Where do Arrivals fit in that pattern? What's your perception?

R: We probably fit in the middle. / You started on outer sectors and quietly built up there. Usually went to Tower attachments as co-ord [coordinator] and then back on to maybe Arrivals and you go back to the Tower and do basically ADC [aerodrome control] which is the senior tower controller and then you would probably go to Approach. That was the general [career path] for everybody. People dropped off along the way as they reached their ability or said *'I don't enjoy it anymore, I don't want to go any further'*. That was how it was then. There was this little pinnacle up the top there and all these people were going *'Hey, we're the Approach controllers. We know how to do the job and you don't'*. Usually, putting others down — *'Oh it's a piece of piss [another controller's airspace]. I could do it... and we used to do it this way'*. That was the general attitude (Int. 54, Controller, Arrivals, Melbourne).

These values still exist as the following Enroute controller discusses what happens when she attempts to communicate with someone on the Approach side of the room.

I: Is there a kind of generation or cultural difference? The old and bold?

R: There's like a line down the middle. It's really weird. The Room is like that. All sectors are around here, and then we've got the Approach. The Approach guys have got an imaginary rope. They are in a little league of their own, and then there's us. Because all the Approach guys are older and been around for years, know everything - there's some lovely guys in there. I find them personally very [inaudible] [but] if I cross that side of the room, it's like, .. I'm not ... I know I'm not supposed to be over here, but I just want to ask a question. Everyone looks at you - *"what are you doing over here?"* There is a definite, even a slightly different culture in a way I guess. It probably is the age I'd say, just the experience and things like that. It is really quite noticeable, even I think from someone from your point of view if you went in there you'd notice it. It's different (Int. 49, Instructor, Enroute, Melbourne).

This example shows how the kind of work undertaken in The Room and its physical organisation sets up differences in work groups. Although different groups could be identified, there was a unifying way in which all controllers talked about their work, regardless of what kind of sector they worked.

5.3.3 Language and stories: Work as play and war

The language used in communication both conveys information and situates people in a social system (Resnick 1993). The language people use to describe their work experience reveals the ways in which their reflections shape their interpretation of their experience. It is necessary to first distinguish between the formalised language controllers use in the course of their work and the informal language they use to describe their work to others. The work activity of ATC involves use of a formalised and specialised language using standard phraseology to enable controllers to interact with pilots and other controllers. This standardised language allows each

agent in the system to anticipate and respond to the requests and actions of the other agents. The clipped phraseologies used in the conduct of a flight are successful because as Weick (1987) suggests, they are anticipated and usually ratify expectations rather than inform. The analysis of the formal dialogue used in aviation work has been analysed at some length by others (e.g., Hutchins & Klausen 1996) and is not the subject of this investigation. That research does, however, illustrate how individuals and groups tacitly share their understanding about work and how these tacit understandings guide practice. Informal language describing work situations and the myths and stereotypes that grow out of that language also provides evidence of what members of the group believe is important and what they have learned.

One of the important aspects of the way language is employed in ATC is what it reveals about the relationships between the agents in the system. Controllers talk of “plugging in” to their “slot” in the room. Commencing on-the-job-training is described as “getting a slot”. The term slot signifies the place the individual has, in relation to the “state of play” of the system and the interdependency between agents. Perhaps because of its history and still close association with the military, the language used by air traffic controllers to describe their work and their learning is often resonant of combat contexts. Policies and procedures governing assessment of learning, for example, are described as “rules of engagement”. People “fight” the system, controllers talk of their work as “going in to do battle” — against the air traffic that is encountered on the shift. A “good” instructional relationship, for example, is based on an intimate knowing of how the trainee is “living the battle” (Int. 51, Instructor, Training Annexe, Melbourne). From the perspective of the trainees, the experience of fighting the system can sometimes be particularly difficult.

- I: You were saying you didn't want to come to work?
R: Oh yeah, that [phase of the training period] just felt like I was walking into the fourteenth round with five more to go with Muhammed Ali. Getting my head punched in rather than knocked out I suppose (Int. 62, Trainee, Enroute, Melbourne).

In this instance, the trainee is not fighting any one person in particular. They are fighting against themselves and their performance is being pitched against what “the system” presents to them on their particular shift. Although this is a stressor for a trainee or someone inexperienced, it is the unpredictability of the traffic patterns when “battling the system” and the problems that have to be solved that give many controllers their job satisfaction. Stories about working these periods of unpredictability (created by the different conditions every day and sometimes the periods of intensity and uncertainty) are sometimes turned into folklore (real and imagined). When shared as narratives of actual experience they are described as “war stories” and when used to project a particular type of controller, they represent archetypes of positive and negative performance (“gun controllers” and “adrenalin junkies”).

5.3.3.1 Shared narratives: War stories

War stories are the stories of a controller's experience where something dramatic happens, perhaps because of a controller's performance (or lack thereof), system deficiency or an unexpected event. War stories are passed informally between controllers and across Centres. Some of them are decades old, others are more recent. War stories are used to help illustrate both good and bad actions, right and wrong ways of operating. War stories have a dramaturgical quality. They often set up an "us-against-other" struggle or battle of some sort and, therefore, are well characterised as "war" stories. The "other" may be another controller, the technology, the environment, oneself or a combination of these elements. For the purposes of this research, every controller who was asked about war stories talked about them in glowing terms. Not everyone could (or would) relay one within the confines of the tape-recorded interview. Given that war stories are often about the consequences of actions gone wrong, it may be that those who were unable to tell a war story were being reticent given that the interview was being recorded. In Appendix 11 four "war" stories are narrated and these will be analysed in greater detail in Chapter Eight to uncover the ways in which narrative forms part of collective memory and reflection. The language used by controllers also reveals what individuals and groups value (or not) about their work activity.

5.3.3.2 The role of collectively held beliefs and values

In order to develop shared meaning, a group must work to create shared beliefs and values. A belief can be defined as a conviction or opinion, or an acceptance of something. Values are beliefs that we determine to be important (Wheelan 1994). Values are underpinned by an evaluation about the worth, desirability or utility of something, or the qualities on which these depend. Values are ideals that arouse an emotional response, either for or against those evaluations. Norms represent collective value judgements about how members should behave and what should be done in the group (Wheelan 1994). How do these elements of culture influence learning and performance and in what way? The following section will outline a number of beliefs found in ATC and will then discuss the ways in which these beliefs become values in work performance when one's performance is evaluated in terms of the presence or absence of these attributes. This is not to suggest that all collective beliefs and values have been identified and are reported on in this Thesis. The beliefs and values described here are best thought of as exemplars and will be used later in this Thesis (Chapter Nine) to illustrate their influence on learning and work activity. Three collectively held beliefs were identified and found in every Centre and within every sector and group. These were:

The importance of ability: A belief that ability is the foundation of expertise in ATC. Consistent with this emphasis on "nature" rather than "nurture" also were beliefs by some that controllers fit a particular type of personality profile which consists of having certain attitudinal attributes such as arrogance, egoism and that these elements are necessary to do the job.

The importance of performance: Performance is the way to demonstrate capability and self-worth. The emphasis on performance results in experience being regarded as the most valuable, and some would argue, only, way to learn ATC.

The importance of confidence: That a necessary (but not sufficient) element of good controlling is confidence in the way one is undertaking the job.

It will be contended in this Thesis that these collectively held beliefs and values influence both accredited and informal learning in the ATC workplace because they form part of the cultural context. They will now be outlined.

5.3.3.3 The importance of ability: having "The Right Stuff"

Tom Wolfe (1979), in his novel *The Right Stuff*, was one of the first people to popularise how "natural" ability was valued in the aerospace industry. In his book, Wolfe described the culture within the US airforce and the career paths that saw some pilots with *The Right Stuff* go on to become astronauts. "At every level in one's progress up that staggeringly high pyramid, the world was once more divided into those men who had *The Right Stuff* to continue the climb and those who had to be left behind in the most obvious way" (Wolfe 1979, p. 30). That certain abilities are necessary to undertake a job such as controlling aircraft and that these capabilities can be screened in recruitment tests is well established (e.g., Hannan 1996; Issac 1994) and is not contested in this Thesis. What is of interest here is the way some controllers and instructors believe that good controlling is obtained only by having *The Right Stuff*: that is, that the skills involved in ATC cannot be learned, and that good controllers are born, not made.

I'm a great believer that flow controllers are born. You don't make 'em, they're born. It's an innate sense, they're very good at mental arithmetic. They're very good at looking spatially and they have very good sixth sense about whether it's going to work or not. And that's something you can't teach people and you don't get it out of a book (Int. 125, Controller, Approach, Melbourne).

As the controller above believes, good controllers are "born and not made". How one detected the presence of *The Right Stuff* also could not be easily identified by any of those interviewed. Identifying the elements that made up having *The Right Stuff* was a source of frustration also for many of the human resource developers and training annexe instructors interviewed. Training Annexe instructors spoke of how on-the-job instructors would complain that a particular trainee "just doesn't have it" (Int. 79, Instructor, Training Annexe, Perth). According to this interviewee, when questioned about what "it" was, the on-the-job training instructor concerned was not able to nominate anything in particular that the trainee was doing wrong. As was illustrated in Chapter Two, there is strong support in the learning theory literature for the claim that experts operate at a certain level of automaticity and, therefore, might not be able to consciously articulate what the "it" is (Chi, et al. 1988). In these cases, individuals who have been performing the task for a long time forget which maxims and rules (Benner, et al. 1996) they are invoking in undertaking the work, making the skills learned opaque, even to themselves. Nevertheless, there are skills that can be learned and even skilful operators sometimes come upon novel situations

for which their existing abilities may provide no clues about how to proceed, requiring, therefore, engagement in learning.

5.3.3.4 The importance of performance

Confidence and ability are qualities embodied in good performance. Good performance in controlling traffic is what many controllers value in themselves and in others. It enables those with The Right Stuff to show their value to others in the room.

I: So they [controllers] then make those assumptions on those immediate facts as they're available, [but] they don't explicate them?

R: / ATC is very much the skilled craftsmen club and secret knowledge and all that sort of, not [right] down to secret handshakes, but as far as — you've [either] got it or you haven't. And you've got it by demonstrating it. So when I was a sector controller, I didn't know anything about ATC to an Arrivals controller — because I hadn't done Arrivals. So then I did Arrivals and I didn't know anything [to an Approach controller] because I hadn't done Approach. So then I went and did Perth Approach. And I don't know anything because the Sydney Approach control is much busier. So then I go [and do] Sydney control and 2 years later, I'm talking to a Perth controller ..., and he says '*oh you haven't done it [Perth Approach] for 2 years [so], you can't be current, [so therefore] you don't know anything about control.*'. So it's very much that sort of — You demonstrate your acceptance [to the group], you know [their] tolerance of you, by the level of skill you do (Int. 18, Controller, Approach, Perth).

It is contended that what is regarded as "good performance" is always relational - it is always linked to how well one's performance is in relation to the performance of others. This is important in the sense that what constitutes "good" performance is always set up, to some degree, by the group and not by external agents. Even objectivist accounts of competencies, for example, have those accounts developed by people with membership and credibility within the particular group or community of practice. In ATC, as in other occupations or activities, value (to the individual and to the work group) comes from how well the individual can perform the task, in relation to others. Demonstrating the qualities regarded as collectively important, such as doing the work fast and doing it well to the degree of complexity required of certain sites, are collectively held values of work in ATC. For example, a rating for a Sydney sector would be more highly regarded (by Sydney controllers) because the work in these sectors is more demanding since Sydney has a higher level of traffic per hour than other Centres. Likewise, having a rating on Approach would be regarded as more important (to Approach controllers) than having a rating in an Enroute air space, because it is arguably more complex and more demanding to operate.

5.3.3.5 The importance of confidence

A good controller is capable in their performance and confident in their belief in their own capacity to do the job. The following controller summarises the widely held view of confidence and its relationship to the job.

I: Why is it that someone who didn't feel comfortable in and of themselves would still go through with having a check?

R: I think, point to prove and ego, says a lot. I don't know if it's just ATCs in that we're all brought up or trained to be, [but] when I sit at that console and I make a decision, I am 100 per cent correct in what I am doing. I will reassess my decision, but every time I make a decision, I am correct in my judgement and I am never wrong (Int. 113, Controller, Enroute, Melbourne).

In every interview mention was made of the importance of confidence and its relationship to performance. Good controllers exercise good "judgement" and have confidence in the decisions they have made. The issues of confidence and its relationship to self-efficacy and experience will be addressed more fully in Chapter Seven and throughout the Thesis.

In summary, three beliefs were widely held throughout ATC Centres about what it takes to be a good controller. These included ability (having The Right Stuff), the role of performance in demonstrating that ability, and the importance of confidence in enabling the application of ability through performance. It is contended in this Thesis that controllers require all three of these attributes in order to perform well. Beliefs also become values when they are applied to evaluate the worth of someone's work quality; that is, ability, capacity to perform and confidence are qualities on which good ATC work practice depends. These beliefs are illustrated as values when they become recurrent themes, shared through informal language, and narrative in the process of collective remembering. Stories and language also translate into myths and legends which when used as resources to share understanding about someone's work activity, represent what is valued about work activity.

5.3.4 Myths and legends: Gun controllers and adrenalin junkies

According to the *Oxford Concise Dictionary* (1993), a myth is a traditional narrative, usually involving supernatural or imaginary persons, embodying popular ideas that are collectively held. Two mythological archetypes were commonly discussed in the interviews about ATC, and like many legends, the two archetypes identified represent the extremes of good and bad performance. In narrative terms, these archetypes represent the "heroes" and the "villains" of an organisation (Alasuutari 1995). A "Gun Controller" is regarded as someone who demonstrates superb performance without even trying (such is their level of skill, ability and confidence). The Gun Controller has a limitless supply of energy, awareness and prescience. Unlike the controller

depicted in the war story “the breakdown of the labouring body” (see Appendix 11), Gun Controllers have overcome the limitations of the body and are never exhausted.

I: What does a controller who’s controlling with flair, or finesse, or a Gun Controller, — what do they do?

R: / A Gun Controller? Oh yeah, there’s a few. They’re just really good controllers. They’re on top of the situation all the time. They can handle a lot of traffic. They work well under pressure. There’s probably in Approach — there’s a few. Not so many now. They were really good controllers. I don’t know if there are any Gun sector [Enroute] controllers. We don’t see them. But the Guns were the Approach/departure controllers and a few Gun Flows (Int. 125, Controller, Approach, Melbourne).

Gun Controllers do not even have to think about what they do, or to use supports such as written calculations (as mere “mortal” controllers may have to). The interviewee went on to explain why the Flow Controller I had sat in with earlier in the morning was not a Gun — because he used a mathematical table he had prepared himself detailing calculations of speed, distance from the airport and estimated time of arrival, which aided him in his work activity. A Gun Controller, according to my informant, would not have needed such a resource, being able to do the calculations in split second timing with 100 per cent accuracy, as and when needed (just as quickly as the metaphorical “top gun” would be able to draw his weapon in a shoot-out). Gun Controllers, by definition, can handle anything, and do so with ease, flair and finesse. Although many controllers believe in their existence, no Guns were identified in this investigation. Not surprisingly, the people most likely to believe in Gun Controllers were those at the apex of the cultural pyramid — Approach — at the apex because their work most of all relies on the display of ability, performance and confidence. The Enroute controllers questioned stated that they had never seen a Gun Controller and even doubted their existence.

The negative construction of the Gun Controller is the Adrenalin Junkie. An Adrenalin Junkie is someone who wants to be a top performer (a Gun) but who doesn’t have the ability to support the performance. The Adrenalin Junkie gets a “buzz” out of performing against “the system”. Perhaps the Adrenalin Junkie takes their position, their “slot” (see 5.3.3, earlier this Chapter) in the state of play to an extreme. Adrenalin Junkies are said to have forgotten that they are working with aeroplanes full of people and see them as blips on a screen, similar to a video-game. Controllers gain satisfaction out of performing well, which involves moving traffic expeditiously. The Adrenalin Junkie is said to have become addicted to the adrenalin produced when performing under such demanding conditions at one’s peak level. The following controller explains the dangers of this approach and its relationship to both the real-time dynamic of the work activity and the consequences for others.

I don’t think we have any other true adrenalin junkies. I think I might have been one once myself but not to this extent. I think the sort of people that we have, like myself,

was we wouldn't say 'No'. We would keep taking aeroplanes on because, after a while, it is like a big sort of caramel lolly or something - you can't break it up into small pieces, you just keep going and keep going and keep going. You can't bite it off or say 'Stop'. You get to a certain level of busy-ness where you don't have the ability to say 'Hey, Stop!' (Int. 96, Controller, Approach, Perth).

In this case the Adrenalin Junkie is likely to not notice his or her limitations have been reached and, in relation to the intensity and real-time flow of the work, can get to a point where the work becomes too busy to split it into smaller sectors. The importance of the value of knowing when one's performance has reached its peak, and thus when one needs assistance or to break the sector up into smaller components becomes an important attribute in good work performance. It should be noted that although people talked about Adrenalin Junkies, none were identified in this investigation, though like Gun Controllers, they were said to exist. Adrenalin Junkies also represent the fine line that is needed between being confident and being cautious because ATC requires controllers not to spend too much time thinking about the lives that are on board an aircraft, but not to lose sight of that fact either.

The thing is I think you will find that there are very few air traffic controllers who actually sit back there and think *'this is an aeroplane full of three hundred people'* and they are just blips on the screen. That is why ... because if they did feel that it was three hundred people, they probably couldn't do the job very well. Some people have gone so far to detach from what we are dealing with [and] they see it as a video game or a pinball game and they bunch them [aircraft] up close together and say *'this will be fine, this will be fine, this will be fine'* and [they are] cutting down the margins for error. That is one of the things we have to change. Okay, they are aeroplanes with people on board. [But] we don't want them to go over-board and say *'Oh Christ, there are several hundred people on this aeroplane'*. At the same time we don't want them to say *'it's just a blip'*. It is somewhere in between. A happy medium (Int. 86, Quality Assurance Officer, location withheld).

In summary, the above discussion sets out a range of collectively held beliefs about ATC work and illustrates the ways in which these beliefs influence how people account for work behaviour and distinguish their behaviour from others as part of the cultural context of the work. In addition these beliefs are transformed into collectively held values about controlling work, as illustrated in the myths and legends and these represent archetypes of behaviour. It is contended that these archetypes are a form of projected occupational identity: the embodiment of an "ideal type" — the Gun Controller — and the negative type — the Adrenalin Junkie.

5.4 Conclusion

This Chapter has addressed the research question "What structures and cultures can be identified within the workplace studied?". The Chapter commenced by discussing the structural elements

which included changes in the relationship between the organisation and its stakeholders which have in turn led to changes in service provision and work organisation. Structural changes have been introduced to reduce the amount of differentiation in job tasks and have included broadening job roles, multi-tasking and flattening the organisational hierarchy. Integrative structures also have been introduced by implementing team-work practices and these will be further discussed in the next Chapter. The ways in which technologies are used and the kinds of activities involved also structure the way the work is undertaken. These organisational characteristics would be expected within a High-3 organisation (see Chapter One). However, this kind of structure can be problematic in terms of changing contexts. According to the literature reviewed in Chapter Two, organisations operating in complex, changing environments need structures with altogether different characteristics: such as decentralised decision making processes with low formalisation. However, an organisation with those characteristics would be untenable in High-3 organisations, given the complexity and goals of their operations. How then, do highly formalised, complex, centralised organisations enable learning to occur in changing environments? Structural changes have been made to the organisation of work as a means of enabling AirServices Australia to respond to a turbulent environment.

The second part of the Chapter discussed evidence of cultures in the ATC workplace. Within this work environment, a number of groups can be identified based on values and interests external to the organisation (occupations, genders, other non-work interests) as well as interests and memberships within the organisation. Group membership is based on structural configurations as well as on values and beliefs that are collectively held. Group membership within the workplace involves identification with current work practice (such as a particular sector or Centre) and identification with a shared history of experience (such as those found within different divisions within the organisation). Collective values and beliefs are often upheld in narratives based on experience and these are sometimes translated into archetypes that can be evaluated for what they show is important within this particular work culture. The values and beliefs become group defining, with individuals deriving their sense of identity from collectively held beliefs and from group membership based on those beliefs. These are the contextual elements important to this Thesis, and this explication now enables the evaluation of their influence on the activity of learning.

Section Three

The analysis

In this section, the analysis of learning in the air traffic control workplace will be undertaken. Chapter Six will set out the conceptual structure used as the basis for the analysis. Chapters Seven to Ten outline the findings by addressing the second research question: "In what ways do organisational structures and cultures enhance and inhibit learning in the workplace?" Each of the findings chapters discusses one of the four processes identified as important in Kolb's model of learning: experience (Chapter Seven), reflection (Chapter Eight), conceptualisation (Chapter Nine), and experimentation (Chapter Ten). Chapter Eleven discusses some of the themes identified in earlier findings Chapters as they pertain to the issue of change. In doing so it addresses the third research question "In what ways do organisational changes, such as the introduction of complex technology, influence workplace learning?" The final chapter addresses the final research question: "How might workplaces be designed to create possibilities for practices of continuous learning and the development of educative work environments?" It provides a discussion of the Thesis, its implications and suggested future research work.

Chapter 6

A conceptual structure for investigating the role of context on learning in the workplace

A model, based on analysing the data in relation to the key elements found in the literature, is presented that identifies and defines elements in the learning process and the ways in which structural and cultural contexts are implicated within those processes as they occur in the workplace. The model is offered as a bridge between organisational and learning theory. The aim of the model is to provide a framework to assist organisational designers interested in enhancing the processes of learning within work activity and also to assist facilitators of workplace learning to better understand the role contexts play in enhancing and inhibiting learning at work. The model sets up a framework that is then used to organise the discussion of the findings in the chapters that follow. These subsequent Chapters address the research question: "In what ways do organisational cultures and structures enhance and inhibit learning in the workplace?"

6.1 Introduction

In Chapter One, two ways in which learning occurs in the workplace were proposed: first as an activity that is embedded in work (i.e., as a continuously interacting and dialectical process) and secondly, as a formalised means of gaining workplace skills where the learning undertaken has a finite endpoint. Chapter Four illustrated how both forms of learning are important in the aviation industry in general and in the ATC workplace in particular. As discussed in Chapter Two, attention is being increasingly paid to the role of contexts and the relationships between learning and contexts. Chapter Three summarised the methodological considerations taken in this study and the last Chapter mapped out the structures and cultures present in the ATC workplace.

The purpose of this Chapter is to abstract the framework used in this Thesis to illustrate the ways in which contexts are implicated in processes of learning in the workplace. However, according to Latour (1987), problems arise when abstractions are cut off from the elements that tie them together. They “float like flying saucers” (p. 242) above the material world that was once their basis. So, duly warned and proceeding with caution, the framework will be presented as a means of linking organisational and learning theory and to set up the structure for the findings chapters that follow. Having set up the framework used to examine the linkage between learning and contexts in the workplace, the following chapters will address the question:

- In what ways do organisational structures and cultures enhance and inhibit informal and accredited learning in the workplace?

Those four chapters will be framed by four processes salient in Kolb’s (1984) theory of learning: experience, reflection, conceptualisation and experimentation.

6.1.1 Using Kolb’s processes of learning as a framework

Kolb’s theory is used as the foundation in this Thesis because it highlights the importance of experience and emphasises learning as a process and a cycle - a notion central to the goal of continuous learning. It will be argued that Kolb’s theory, with modification, provides a useful framework for integrating many of the elements identified from both individual and sociocultural theories of learning and provides a useful means of then linking these elements of learning to structural and cultural elements of workplace contexts. Before identifying the modifications needed to Kolb’s theory, its utility and weaknesses will first be outlined.

Kolb’s work draws on Dewey (1933, 1938), Lewin (1951) and Piaget (1960) in contending that learning occurs as a result of a resolution of a contradiction or conflict between opposing ways of dealing with the world: between reflection and action and between doing and thinking. Underlying these processes of learning about the world is the notion of apprehending (or grasping understanding) and comprehending (understanding and moving on). As discussed in

Chapter Two, for Kolb (1984), there are four elements involved in the learning process (experience, reflection, conceptualising, and experimenting) that must be present for effective learning to occur. Learning was defined in Chapter One as the process involving the transformation of experience through reflection, conceptualisation and experimentation which leads to an increased capacity in individuals, groups and organisational systems, to act in the environment (after Kolb, 1984). Kolb's work has been used as a framework for learning in a number of other organisational contexts (Swieringa & Wierdsma 1992; Dixon 1994) and establishes a bridge across the various processes involved in learning.

One gains experience through doing; reflecting is the mediating on this experience; thinking is the attempt to understand that experience by means of analysis and conceptualisation; one then makes choices, decides on the next steps and then the cycle repeats itself (Swieringa & Wierdsma 1992, p. 23).

As a framework for accounting for learning, Kolb's model has a number of strengths as well as weaknesses. An important strength, according to Swieringa and Wierdsma (1992), is that Kolb does not make the mistake of equating learning with the acquisition of knowledge. For Kolb, learning must be evident in what people do. Secondly, in organisations, problems are both the stimulus and the medium for learning (Knowles 1984; Swieringa & Wierdsma 1992; Engstrom 1994). In this respect, Kolb's model is directly applicable to conceptualising how people in organisations may experience problems and learn from them. Thirdly, his model draws on explicit phases that are necessary for effective learning to occur and thus provides a useful framework for explicating processes of learning developed in this Thesis.

However, Kolb's model also has a number of weaknesses. Although Kolb (1984) discussed the dialectical movement between the various processes involved in learning, Kolb's work has been popularised as a set of four "stages" involved in the learning cycle, and these are presented almost as if they are discrete entities that occur in a linear cycle. It is contended that the very nature of a dialectical process means that engagement may move back and forth between processes such as reflection and experience (or any other parts of the cycle) before progress in learning is achieved. Thus these four elements of the learning cycle identified by Kolb are very difficult to tease out as distinct phases and may be fused within a particular activity. In this Thesis, however, for the purposes of expediency and clarity the four elements are presented individually, although this is not to suggest that they are discrete or occur linearly.

The second weakness is that Kolb extends his experiential theory learning to develop a series of static learning "styles" that individuals are said to possess. Indeed, most of the usage made of Kolb's work is based on this notion of learning "types" or styles (e.g., Dyrud 1997; Knight, Elfenbein & Martin 1997). In this Thesis, the concept of "learning style" is not discussed in this Thesis. It is argued that it is neither helpful nor desirable to pursue such a notion when looking

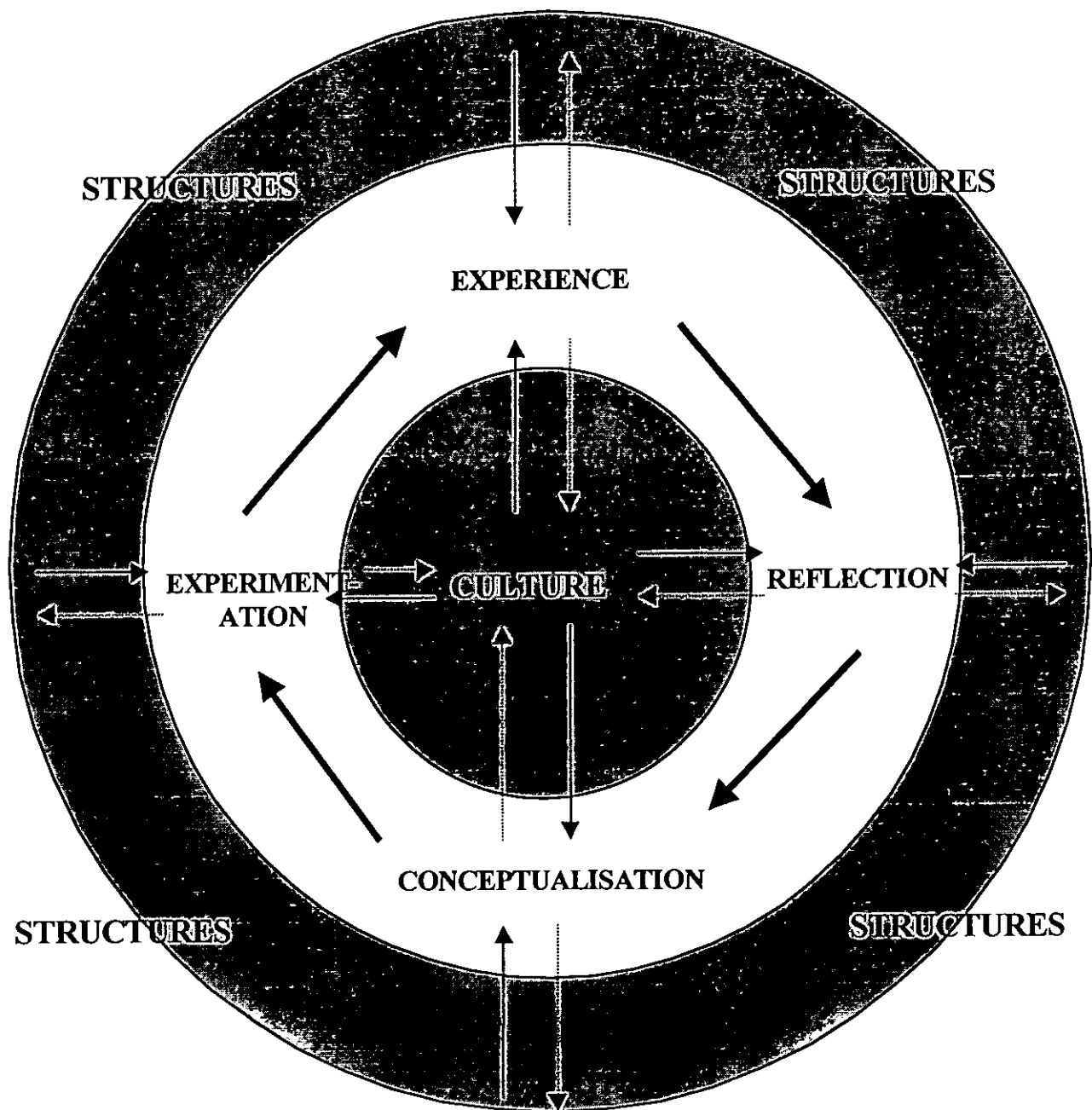
for ways to enable individuals, groups and organisations to engage in continuous learning in changing environments. The focus of this Thesis is on investigating the influence of contexts on enabling or constraining processes involved in learning. Therefore, the concept drawn from Kolb's theory relevant to this Thesis is the notion of learning as a cyclical process which involves the four stages mentioned above. However, for the purposes of this Thesis, these stages too need to be modified and this raises the third weakness in Kolb's model. It is argued that the terms Kolb uses to frame learning (concrete experience, reflective observation, abstract conceptualisation, active experimentation) are unduly limiting. It is contended that each of these aspects of the learning process can involve dimensions other than ones that are concrete (in terms of experience), or based on observation (in terms of reflection). Varying levels of abstraction in terms of conceptualisation and experimentation might involve the teasing out of "what if" statements rather than direct action. Therefore, for the purposes of this Thesis, the following definitions of the four elements are offered:

- Experience occurs as part of being-in the world and may be registered through what we see, think, hear and feel as we interact with our environment. It may occur directly or may be experienced indirectly through others (e.g., vicarious experience).
- Reflection is the process involved when attending to, noticing, recalling elements that are significant in the experience and can be either passive or active.
- Conceptualisation is the process of thinking about, making sense of, interpreting and comprehending those reflections and experiences.
- Experimentation is the activity associated with developing choices and envisioning new ways of acting that may have occurred in the past, be occurring in the present or likely to occur in the future.

The final weakness of Kolb's theory is that, like other psychological approaches, it ignores social context and thus emphasises learning as an internal individualistic process (Jacobson 1996). The main purpose in this Thesis is to demonstrate the embeddedness of learning and context. As a structure Kolb's model, therefore, needs to be able to illustrate the influence of contexts on learning in the workplace (see Figure 13). Figure 13 shows how the elements of context influence the processes involved in learning. The linkages evident in the Figure are bi-directional to indicate how these contextual elements both influence and are influenced processes of learning. Within organisations, these contextual elements are conceptualised as organisational structures and cultures.

The Figure also assists in integrating elements of sociocultural perspectives with Kolb's (1984) model. So, for example, from a sociocultural perspective, the social environment—the work group and other communities of practice — influence learning (social cognition). Learning is

Figure 13: Kolb's model as a framework to link organisational contexts and the processes of learning

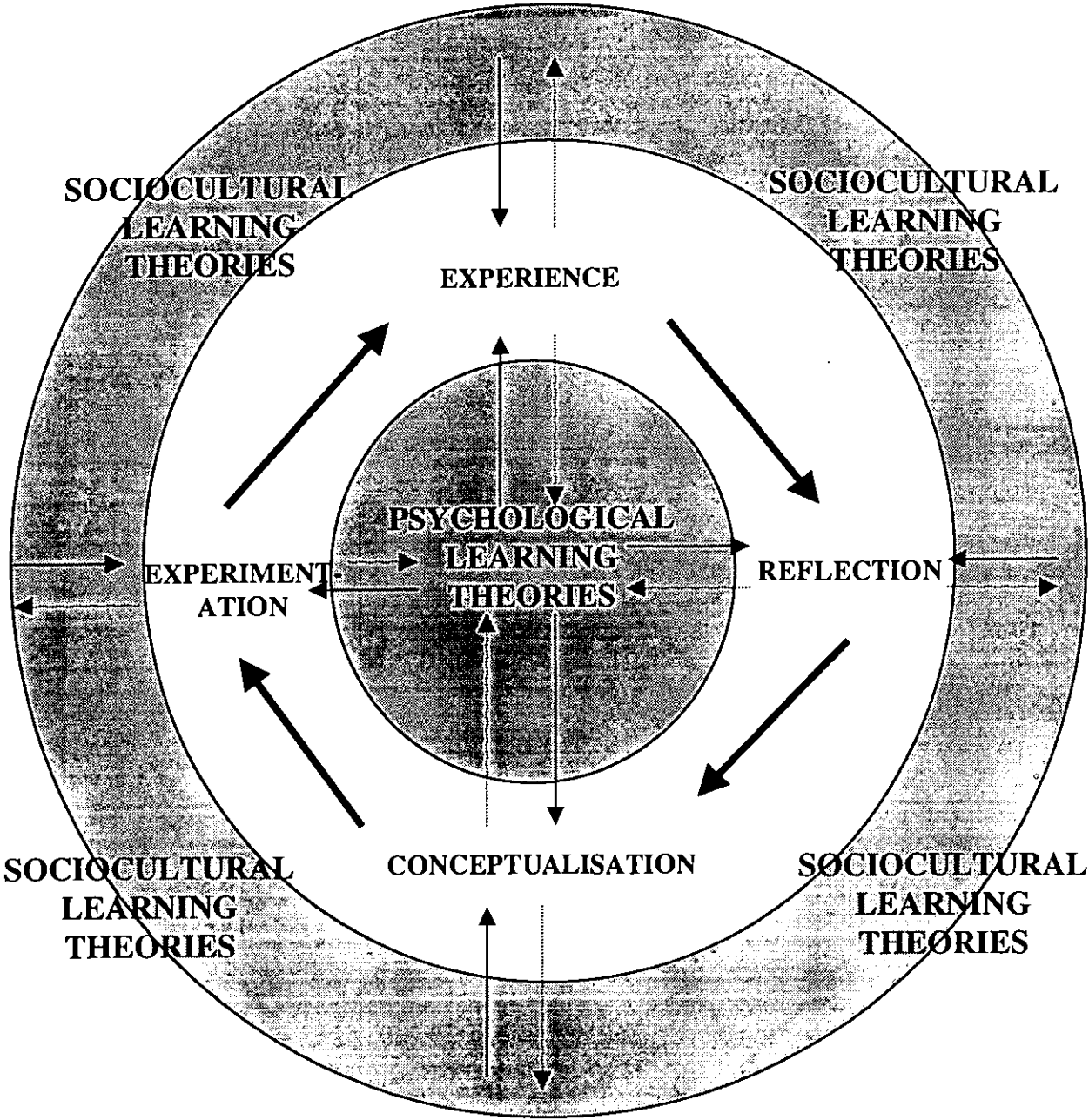


by elements found within the immediate situation (situated cognition). The tools and physical resources people have available to them (distributed cognition) would also structure their learning, as would histories of previous experiences of people and their structural roles within activity systems (activity theory).

Kolb's four phases of learning are important because they draw attention to these elements as necessary components of the learning process. It will be argued in later Chapters, however, that integrating the contextual with Kolb's cycle of learning is only possible if the terms used to define the elements in the learning process are expanded (as discussed above) and more inclusive in their definitions.

Although the literature supporting Kolb's model is not overwhelming, it provides a readily accessible schema for the purposes of this Thesis. It will be argued in this Thesis that Kolb's model, with modifications as described, can be used as a means of linking the two perspectives of learning theory: the individual psychologistic theories and the sociocultural perspectives (see Figure 14). This Figure shows the four processes involved in learning in the middle of the diagram. In the centre, would be found those concepts that are important to this Thesis from psychological learning theory. These include practice (e.g., involving all the processes of learning, though closely linked to experience), self-efficacy (e.g., closely linked to reflection), mental models or structures of knowledge (e.g., linked with conceptualisation), pattern generation and action (e.g., linked with experimentation). Around the periphery of the Figure are the sociocultural perspectives. Those pertinent to this Thesis include social cognition and discourse communities, distributed cognition and activity theory. The development of a contextual model of learning based on Kolb that utilises aspects of both theories of learning (psychologistic and sociocultural) and links these to organisational contexts will be summarised below and developed in later Chapters.

Figure 14: Kolb's model as a framework for linking aspects of psychological and sociocultural theories of learning



6.2 A conceptual framework for evaluating the influence of contexts on learning in the workplace

The following Table summarises the main elements of the framework that will be discussed in detail in the following Chapters. Table 11 maps the linkage of contexts with the various processes identified as important in learning.

Table 13: The linkage between elements of context and processes involved in learning

LEARNING PROCESSES	ATTRIBUTES	STRUCTURAL ANALOGUES	CULTURAL ANALOGUES
Experiencing	Being <ul style="list-style-type: none"> • corporeally (Body) • cognitively (Mind) • affectively (Self) • socially (Environment) 	Physical work organisation. Dimensions of work experience: temporally, complexity, affectively, socially Differentiation and integration of job tasks and roles.	⇐ Marked, remembered, accounted for and generated through ⇓
Reflecting	Observing narrating/remembering; noticing; pattern seeking; labelling	Work organisation. Integration structures <ul style="list-style-type: none"> • Job roles (+) • Teams (+ -) Formalisation	Collective remembering (e.g., war stories) (+). Shared meaning (evident in informal language used by groups/ symbols).
Conceptualising	Thinking about, sense making; schemas used to interpret, explain, account for; (re) framing; pattern generating.	Integrative structures (e.g., boundary spanning functions). Job Roles	Collective remembering Collective schemas <ul style="list-style-type: none"> • shared beliefs and values, (stereotypes) • shared norms
Experimenting	Acting; envisaging/enacting; developing choices validating/testing; (re) evaluating; adapting/innovating; obtaining feedback.	Integrative structures <ul style="list-style-type: none"> • Teams • Boundary spanning. Centralisation. Formalisation.	Norms of practice (+ -). Collective remembering (+). Collective schemas (e.g., stereotypes) (-).

(+ : enabling; -:constraining)

Table 13 expands on the four processes important in Kolb's theory of learning (see Chapter Two) and links them with appropriate contextual features important in air traffic controller's

work structure and culture. The Table lists the attributes identified as important within each of the four learning processes. The next column then summarises the structures that were identified in the study as important in influencing each learning process. The cultural analogues that are influential are listed in the next column. In terms of experience, it will be shown in subsequent chapters how these cultural elements are marked, remembered and accounted for through reflection and conceptualisation on experience, leading to experimentation.

It is important to point out that the Table summarises structural and cultural elements regarded as important within each of the processes of learning. Therefore, items listed in the framework are not exhaustive or mutually exclusive. For example, as a structural element, formalisation is implicated in the data as influencing the process of reflection, as well as experimentation. Similarly, as a form of work organisation, team-work both enables and constrains opportunities for reflection (indicated by + and -). Likewise, both reflection and conceptualisation are occurring when narration of stories ("war stories") are used as a resource for learning. Although the cycle of learning proposed by Kolb could start anywhere, a useful starting point is with experience, since, it is contended, experience is central to learning (Boud & Miller 1996; Brookfield 1990, 1993).

6.2.1 Experience as a process of learning

According to Boud and Walker (1993) "experience is created in the transaction between the learner and the milieu in which he or she operates - it is relational" (p. 11). Hence, it is contended, experience is mediated by organising devices (structures) and by interpretive processes (cultures). Experiencing is always grounded in some context and is, therefore, influenced by artefacts. In the workplace context for example, experiences are structured by the artefacts used in work organisation, such as the physical resources, policies governing activity which structure workplace experience, and opportunities for experience. However, experience also involves perception, implies consciousness and always comes with meaning (Boud & Walker 1993). Given that interpretation of meaning is the foundation for culture, culture is thus always embedded in the interpretation of experience. The structuring and interpreting of experience will influence opportunities for learning in certain ways because structures will make certain opportunities available and not others and cultures will focus attention on particular interpretations of the experience and not others.

In this Thesis it is argued that we experience the world principally in four ways: cognitively, corporeally, psychologically and socially: that is, we experience the world through our bodies, our minds, through our feelings as we interact with our environment. The theories of learning discussed in Chapter Two conceptualise the relationships between these categories of experience in different ways. Traditional psychological theory, on the one hand, has assumed that the brain and body, the self and environment can be examined separately: brain *in* body; self *in* environment. On the other hand, according to sociocultural perspectives the body and the brain, the self and the environment are not dualisms as was once assumed within psychological learning

theory. Theories of social and situated cognition draw attention to the ways in which these dimensions of experience are integrally linked to situation and context. For example, rather than viewing a person as being “in” an environment “just like a cherry in a bowl” (Bredo 1994, p. 28), the activities of person and environment, and of the mind and body, are argued to be part of a mutually constructed whole. “The inside-outside relationship... which is generally presupposed in a symbol-processing view, is replaced by a part-whole relationship” (Bredo 1994, p. 28). From this perspective, experience involves the self in relationship with the environment, and the mind is not something separate from body or environment but part of a mutually shaping cycle of interaction (brain *and* body, self *and* environment).

This is the first point where Kolb’s framework provides a useful linkage between aspects of learning theory and organisational contexts, since organisational structures shape experience in many ways. The embeddedness of elements of structures with experience is the foundational underpinning of sociocultural theories such as distributed cognition and activity theory (see Table 13).

In the field study the structuring of ATC work was observed to influence experience in particular ways. Drawing on the components of how we experience the world (cognitively, corporeally, affectively and environmentally) it will be argued in Chapter Seven that particular aspects of ATC work structure emphasise various aspects of experiencing. For example, the temporal dimension of experience is emphasised in the “real time” dynamic of the job). Complexity is evident in the nature of job tasks that require higher order thinking and problem solving. An affective dimension is also evident in, for example, the importance given to individual and collective decision making as an expression of self and group. Finally, a social dimension is evident in the interdependence of job tasks. It will be argued in Chapter Seven that these dimensions of experience are characteristic of work generally, but are especially important in High-3 work in particular. Work may be intense on the body; easy or demanding on the mind; an expression of, or alienation of, the self and it always occurs in a social environment, although some forms of work organisation provide more emphasis of the “social” than others. It is argued in this Thesis that the way work is organised shapes opportunities for experience in certain ways and that these organisational structures influence the transformation of experience into learning by enabling or constraining the transition to the next moment in the cycle — reflection.

6.2.2 The importance of reflection for learning in the workplace

In learning theory terms, reflection is an essential ingredient for learning (Brookfield 1993; Schon, 1991). Reflection involves attending to the salient features of an experience, marking and noting those features through labelling and pattern seeking. It consists of those moments individuals engage in to recapture, observe and notice and to begin to make sense of their experience, “to work with their experience to turn it into learning” (Mason 1993, p. 9). It will be contended in Chapter Eight that there is a close link between individual and collective processes of both reflection and the next phase of the learning cycle, conceptualisation (or making sense of

reflections on experience). Both reflecting and conceptualising are emphasised in psychological and sociocultural theories of learning, though as expected, psychological theories of learning emphasise these processes as they occur for individuals and sociocultural perspectives emphasise these processes as they relate to the social context (see Figure 14). Individually, the degree to which reflection is engaged in will depend on the motivational levels of the person to make sense of the experience and their interpretation will be influenced by their sense of self-efficacy. In workplace contexts cultures are based on the salient features of experience which are noted, collectively remembered and attended to through narration and through the common language and symbols that groups use to share and express their experiences with others. In the field study reflection was observed to occur culturally, as part of shared remembering evident in the telling of war stories. War stories, as well as the informal language controllers use to describe their experiences are a collective process of reflection because they draw attention to what is worth noticing, and thus worth learning, and what is not. In addition to these cultural processes, organisational structures also enable and constrain opportunities for reflection.

In terms of structure, capacities for reflection are variously designed into job roles. The form of work organisation characterised by Taylorism, for example, was predicated on the basis of removing opportunities for reflection (and conceptualisation) from certain job roles. In the field study the way the work was structured both enabled and constrained opportunities for reflection. Reflection through observation, for example, was enabled through the visibility of work designed into the work-space and through the organisation of job tasks and roles (e.g. on-the-job instruction). Organisational structures also constrained opportunities for reflection on experience, however, through the organisation of work activity where the experience of the temporal dimension of work (e.g., its intensity and immediacy) limited opportunities for stepping back and reflecting on what was happening. In these contexts, cultural processes of reflection, found in shared remembering through narration, become particularly important as a compensatory mechanism for the ways in which structures limit this process of reflection. Structures and cultures also enable and constrain the next process in the learning cycle, conceptualisation.

6.2.3 The role of conceptualisation for learning in the workplace

The next phase in the cycle, conceptualising, is the process of making sense of what has occurred, to interpret reflections on experience and to generalise these interpretations to new settings. Many learning theorists find it difficult to tease out reflecting from conceptualising, since the process of making meaning relies on the interconnection of noticing, interpreting and making sense (see Argyris & Schon 1978; Boud et al. 1993; Boud & Walker, 1993; Brookfield 1993). Nevertheless, for the purpose of this Thesis, the processes of reflection and conceptualisation in learning have been separated although it is acknowledged that in the everyday world these elements are closely intertwined. The conceptualising process begins with the elements of reflection (observing, noticing and labelling which triggers remembrance).

Conceptualising is a practice whereby the meaning from the experience is generated into concepts or ideas that can apply to situations beyond an explanation of the immediate experience. As such, conceptualising also has been called theorising. Mason (1993) commented that the term *theorising* is based on the Greek root *theoria*, meaning *a way of seeing and abstracting*. One of the meanings of abstracting is the search for or distillation of essence or structure. Mason's comments demonstrate also the close linkage between the processes of conceptualisation and experimentation — the next element in the learning cycle, since noticing and interpreting leads to the development of alternatives that can be used in the future. Conceptualising, or generalising from one experience to another, involves identifying patterns in experience found through reflecting and generating ideas about those patterns in other events. Organisation and categorisation of perceptions enables comprehension and interpretation of the social world. In theories of "reflective learning" or "reflection-in-action", (Argyris 1977, 1985; Argyris & Schon 1978; Boud et al. 1993; Brookfield 1987, 1990, 1993; Kasl, Dechant, & Marsick 1993; Schon 1983, 1987, 1991), the elements of reflection and conceptualisation are evident but not separate. For these theorists the processes of reflecting and conceptualising together are called "reframing". That is, when an initial perception is transformed into a new understanding or frame.

Sometimes conceptualising or reframing is constrained, however, by what is observed or noticed, a feature that is important in social cognition and constructivism. For Resnick (1993), interpretation of experience is based on schemas that both enable and constrain individuals' processes of sense-making. A schema provides an interpretive framework that allows reasoning to proceed (Resnick 1993). As an interpretive framework, a schema is often based on past history, sets up expectations about what will be important, and therefore, will help guide what we attend to, what is perceived, what will be remembered and what will be inferred. Schemas are not purely individual constructions but are heavily influenced by the kinds of beliefs and reasoning schemas available in the individuals' surrounding culture (Resnick 1993). Individual and collective schemas are thus obviously mediated by cultural contexts, since organisational cultures are based on collectively held beliefs and values (where schemas or shared mental models are embedded) and these in turn generate norms of practice (Augoustinos & Walker 1995; Hendry 1996). It will be argued in Chapter Nine that the contextual elements of organisational culture (such as collectively held beliefs, values and norms) are resources used in the conceptualisation process because they influence perceptual selectivity and the development of individual and collective schemas about work practice. In addition to influencing events, collectively held beliefs and values also will be reproduced by individuals and groups in the kinds of continuous learning strategies used in work activity. Collective beliefs and values, therefore, will lead to some things being noticed rather than others. Thus, schemas enable and constrain both individual and collective opportunities for learning.

In addition to culture, conceptualisation is influenced also by organisational structures when the activities of explaining, accounting for, and pattern generating are built into job tasks and roles.

Clearly in complex organisations, characterised by the need for high reliability, where the demands of work extend beyond any individual's capacity, the responsibility for task completion rests not just with the individual, but is also placed within the group. This is particularly so in work environments designed with high levels of interdependence in work activity. Indeed, within the human factors literature, "shared mental models" has been a recent focus of research investigating performance in High-3 organisations (e.g., Helmreich & Merritt 1998; Orasanu 1995; Reason 1998; Westrum 1997). Such research has pointed to the ways in which unstated interpretations (mental models or schemas) become assumptions upon which action is based, sometimes with devastating results. The conclusion of such research is that practices associated with continuous inquiry are crucial in High-3 environments and procedures have been developed (the basis for crew resource management - see Chapter Four) to ensure that mental models are shared, making work more reliable. This is important because in High-3 workplaces traditional means of learning, such as the trial and error (generally associated with experimentation), are not available. Nevertheless, opportunities for experimentation are evident in a range of ways.

6.2.4 Experimentation in the workplace

The fourth phase in the learning cycle is experimentation. According to Kolb (1984), learning is limited if an individual formulates concepts to generalise to other settings, but fails to test their validity. It is contended in this Thesis that testing the validity of conceptualisations, based on reflections on experience, can be done through evaluating past experience and envisaging new alternatives to be put into action immediately or some time in the future.

Envisaging new alternatives may occur also in thinking about past actions (reframing). In this case an expansion of the range of choices available might be made though they may or may not be acted upon in the future. Therefore, for the purposes of this Thesis, the term "experimenting" has been emphasised because it can involve reframing actions that occurred in the past, action to be taken in the present and also it can mean developing choices to put into action in the future. Experimentation then, refers to developing choices and envisaging new ways of acting. These choices and alternatives are tested out mentally and/or practically through developing alternative plans of action for the future and acting on those alternatives when appropriate.

Expanding the range of choices and alternatives available is mediated by conceptualisation, which, as previously discussed, involves generalising concepts to new settings. Argyris (1976) proposed the idea of "single loop" and "double-loop learning" (see Chapter Two) as an indicator of the ways in which developing choices for future action was mediated by conceptualisation. Individuals and groups involved in single loop learning have limited alternatives and possibilities for action available to them because they operate without testing the basis of their understandings and assumptions (based on their beliefs and values) about the problem or situation. When organisational members have the awareness and ability to recognise their

underlying assumptions and to test their validity, and modify their thinking, double loop learning occurs.

It will be argued in Chapter Ten that organisational contexts enable and constrain opportunities for experimentation for both individuals and groups. Structures such as team-work, for example, increase possibilities for experimentation because they enable a shared continuity of experience to occur across team-members and thereby enable the experience to be used as a resource for inquiry to generate increased possibilities for action. Similarly, the degree of formalisation within a workplace may limit the capacity for individual experimentation, though policies and rules formalising work activity may also embed behaviours aimed at generating alternatives into job tasks and roles. Organisational culture influences individual and group opportunities for experimentation to the degree that such practices are enabled and constrained by collective norms of practice, shared conceptual schemas that account for how the world works as well as shared capacities for collective remembering.

6.3 Conclusion

The basic research question of this Thesis is: In what ways do organisational contexts (structures and cultures) enhance and inhibit learning in the workplace?

The findings chapters ahead will show that organisation contexts influence opportunities for learning in the workplace when they enable or constrain:

- individual and collective involvement in activities associated with each of the four processes involved in learning;
- transition between the processes and integration of them;
- the transfer of insights from engagement in these learning processes within and between individuals, groups, and organisational systems.

This Chapter has summarised a framework that has been developed, from the literature and the data analysis, to embed learning theory within organisational contexts to provide an adequate account of workplace learning. As such, the framework acts as a bridge between organisational and learning theory. The components of the framework (such as the four specific learning processes identified by Kolb and the elements of structure and culture from organisation theory) will be used to investigate and analyse the data in subsequent chapters to determine the influence of contexts and how they enhance or inhibit learning in the workplace. Examples will be used from both accredited and informal workplace learning to demonstrate the influence contexts have on enabling and constraining the four processes of learning used in the framework.

In the final Chapter the framework will be used to draw the findings together and to present a model illustrating how contexts influence workplace learning. Here it will be argued that the model will enable practitioners of organisational design to consider the ways in which activities associated with learning can be built into the workplace, and practitioners of workplace learning

to consider the ways in which organisational features influence engagement in learning. It is argued in concluding the Thesis that practitioners of organisational design and workplace learning can use the framework as an tool to identify strategies to enhance both accredited and informal learning in the workplace with the aim of making learning a continuous process embedded in work activity. The Chapters that follow will explicate the ways in which these elements of context both enable and constrain learning so that a better understanding can be gained to enhance engagement in those learning processes as part of work activity and to enable the transition between moments that are important in the learning process. These are the elements that must be attended to if continuous learning is to be a goal of the workplace.

Chapter 7

The experience of ATC work

In this chapter the nature of work experience and the ways in which structures of work organisation influence those experiences are discussed. It will be shown how the nature of the physical organisation of ATC work shapes experience in certain ways. The Chapter discusses the ways in which the work is undertaken emphasising temporal, complex, affective and social dimensions of experience. It will be contended that the physical structuring of work organisation has implications for both performance of ATC work and its learning, and sets up the establishment of cultures. Such workplace organisation also has implications for subsequent stages in the learning process that enhance and inhibit transitions between experience and reflection and this will be discussed in later Chapters.

7.1 Introduction

It was contended in the last Chapter that experience is central to meaningful learning, and that organisational structures shape the kinds of experiences people have in the workplace. In this Chapter the dimensions of experience of ATC work will be further developed using the framework outlined in Chapter Six. This Chapter discusses how workplace experience is shaped by organisational structures and argues that in the ATC workplace such experiences can be described in terms of four dimensions. It is contended that the structure of ATC work is experienced temporally, cognitively, affectively and socially. These dimensions will be discussed in relation to the implications they have for work performance, for informal learning embedded within work activity as well as for accredited on-the-job training. Discussion of each dimension will include what instructors look for as evidence of progress when someone is learning that particular aspect of work experience, as well trainee experience on what each dimension means to them in engaging in accredited learning on-the-job.

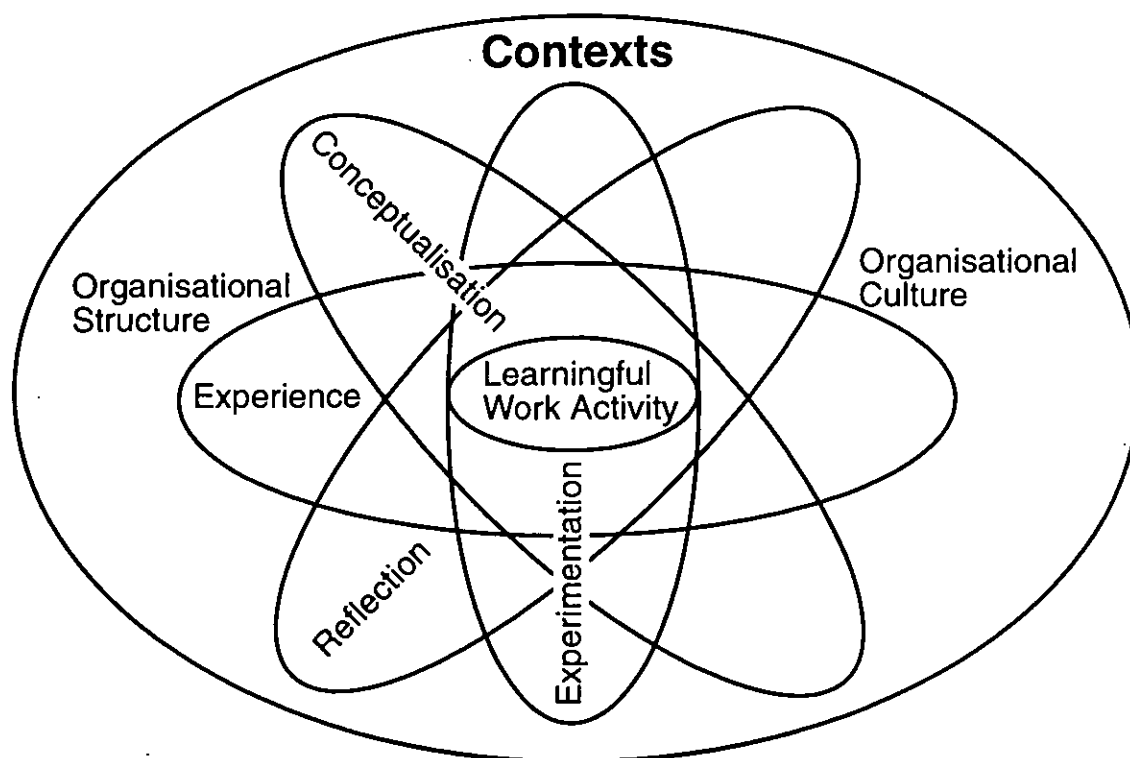
The Chapter:

- discusses the dilemma of trying to separate the act of experiencing from the other elements in the learning process;
- identifies the ways in which experience of ATC work is influenced by workplace structures; and
- gives an account of what these experiences mean for the attributes of good performance that need to be, first formally learned and then, engaged in as part of ATC work.

7.1.1 The embedded nature of experience in learning: A cautionary note

It is contended that the very nature of *experiencing* is likely to have embedded within it the processes of reflection, conceptualisation and experimentation. However, for the purposes of this Thesis, even though it is acknowledged that these processes are closely interlinked (see Figure 15) for the sake of clarity each of these phases will be examined separately, something akin to a snapshot. The challenge, then, is to identify the influence of contexts on enhancing and inhibiting the transformation of experience into learning. That is, to identify the ways in which structures and cultures enable or constrain transitions between experience, reflection, conceptualisation and experimentation. The first step, however, is to identify the influence of context on the various elements of experience within the ATC workplace.

Figure 15: The embeddedness of all of the processes of learning within experience.



7.2 Experiencing ATC work

In the ATC workplace, organisational structures shape experience across four dimensions. These dimensions of experience are listed in the first column of Table 14. Analysis of the data found that work is structured so that the temporal nature of experience is emphasised. Temporally demanding work occurs in a dynamic “real time” environment; it involves periods of intensity, working within short time-frames and it requires skills in concentration and immediacy (involving “living in the now”). This dimension of experience is often registered in the body. Second, the work is structured so that it is also experienced complexly. Complex work requires the coordination of multiple tasks that in turn require higher order thinking and in combination with the temporality of work, practice is needed to build up awareness and understanding of the various permutations of problems and problem solutions that successful task completion may require. This dimension of experience uses the brain and thus cognition. Third, work is experienced affectively. That is, the act of working involves the self and is an expression of the self to others. Individuals both contribute to effect (and affect) the work undertaken and the work, in turn, affects the individual. From work one gains a sense of self-esteem and identity. In High-3 work, one works intensely at a complex activity that includes risk and once commenced, cannot be easily stopped. The risks taken in undertaking the work are publicly available for others to

observe and involve a sense of one's own self-efficacy (Bandura 1997) in the process. This dimension of experience involves the psychological self (Brown 1998). Finally, work is experienced socially. That is, work is shared and is organised such that each individual is interdependent with others who form groups which in turn are interdependent with other groups.

Table 14: Work experience and its impact on ATC workplace learning

DIMENSIONS OF EXPERIENCE	CONTEXTUAL FEATURES/ STRUCTURES INDICATED	EVIDENT IN ASPECTS OF WORK PERFORMANCE	LEARNING WORK ¹
Temporal : <i>real-time, short-term ; intense.</i> (Corporeal - Body)	Way work is organised Nature of work activity	• Use of body (body-clock, monitoring)	Body-clock development Anticipation
Complex: <i>work strategies in decision-making</i> (Cognitive - Mind)	Formalisation (rules and procedures e.g., policies to reduce complexity)	• Level of job autonomy and decision making; • Using artefacts to aid in problem solving	Problem recognition Prioritising Problem solving Development of multiple strategies
Affective <i>presentation of the self, evaluation of performance of self</i> (Psychological - Self and identity)	Nature of work - high reliability; Physical work organisation - visibility	• The embeddedness of performance with affect: confidence	Confidence (Impression management) Self awareness Independence Learning limitations
Social: <i>interdependence, visibility, system interdependence</i> (Interaction with Environment)	Physical work organisation (spatio-locations of sectors) Integration of job tasks Teams	• Strategies to monitor interdependence • The requirement of authentic performance	Developing the third ear Developing situational awareness of others Learning who to trust

¹ What instructors look for in trainees during on-the-job-instruction

Table 14 summarises from the data the structural aspects of work organisation that give rise to the various dimensions discussed above and how these become evident in work performance. The Table also summarises what instructors look for when monitoring and assessing development in accredited learning. These dimensions of experience interact with one another in the course of the work and these interactions are summarised in Table 15.

Table 15: Elements of experience and attributes displayed in good ATC work

	TEMPORAL	COMPLEX	AFFECTIVE	SOCIAL
TEMPORAL	<i>responsiveness</i> <i>intensity</i> accurate timing (body-clock) concentration vigilance (scanning) awareness and monitoring	Perseverance		
COMPLEX	Situation awareness Pattern recognition Longevity	<i>variability</i> visualisation judgement holistic understanding	Interdependent sentience: • referential anchoring • work synchronicity • collective memory	
AFFECTIVE	awareness of own strengths and limitations Confidence Self presentation	Authority Self-efficacy Impression management	<i>physiological and psychological arousal</i> involvement of self	
SOCIAL	Strategies to monitor flow in relationship with others third ear	Interdependent understanding awareness of consequences for others	Individual and social identity	<i>systemic interdependence visibility</i>

Table 15 shows, in italics, the aspects of experience that arise from the physical structuring of work organisation (e.g., intensity) that were discussed in Table 14. Table 15 shows the attributes controllers must learn to develop in accredited learning and use when engaging in informal learning on-the-job. The attributes represent the different combinations of the dimensions of experience. Reading

diagonally across the Table, from left to right (identified in the Table by the bold boxes), are the attributes that are important within each dimension of experience. The temporality of work, for example, requires responsiveness as a result of intensity; its complexity leads to variability; its affectivity leads to physiological and psychological arousal and the sociality of work leads to systemic interdependence of the various actors involved in the work system. The Table also lists those aspects that are identified as the attributes that good controllers must develop and demonstrate (e.g., body clock development that enables the controller to establish accuracy with timing) and these aspects will be discussed throughout the Chapter. The Table also lists the various combinations of dimensions. The attribute of perseverance, for example is needed as a result of the work being experienced as both temporally, complexly and affectively (represented in the Table by the shaded area). The attributes referred to later in this Chapter as “interdependent sentence” are needed as a means of experiencing work temporally, complexly, affectively and socially. These attributes are presented in this way because, as was discussed in Chapter Six, the ways of experiencing the world are not presented as dualisms (mind/body; self/environment; individual/group) but are recognised as inherently linked together and inseparable. This assumption is supported by sociocultural theories of learning (see Lave 1996; Suchman 1987) and is the basis also for assuming that contexts are vitally important in workplace learning. Nevertheless, for the purposes of this Thesis these dimensions will be discussed individually with reference to the various combinations when appropriate.

7.2.1 The temporality of ATC work

ATC work occurs in a dynamic “real time” environment. That is, the work cannot be stopped, the problems confronting the controller must be resolved. Time and time pressure are key features of High-3 work. This time-pressure can sometimes lead to a sense of urgency, though urgency may also be a routine part of the work (recall Chapter Five and Appendix 8, where the time an aircraft may be in a sector was limited in some cases to three minutes). This is one of the elements of work that controllers use to distinguish the uniqueness of their work from the work of others, as the following controller explains.

ATC requires you to complete a task in limited time, whether or not the tools are there to do it. There is no such thing as ‘*I give up*’ at this point. And certainly it hasn’t been in our culture at least. But you have to solve the problem that’s presented before you and with the tools that are available/ if an aircraft penetrates into controlled air space, and it’s not an aircraft that you’re expecting / You cannot say ‘*oh well this aircraft hasn’t a flight plan*’, so you know ‘*back at the end of the queue*’. / You’ll handle the traffic as it happens and you’re expected to manage that workload (Int. 18, Controller, Approach, Perth).

The temporal experience of ATC work calls for controllers to be keeping up with the traffic flow at all times and to be able to respond and act as necessary, as the following controller explains:

If you've got three or four intercom buttons flashing that's a really good sign that you're getting behind. Because you should be able to punch those and get rid of them really quickly and not get to the stage that you're that overloaded. If you've got four buttons flashing, that could be two minutes of work and if you're two minutes behind, you're a long way behind (Int. 58, Controller, Enroute, Melbourne).

This quote illustrates both the time pressures involved and the short term nature of task completion. These two attributes give the work experience its intensity. The pace and the intensity of the work result also in controllers developing good short term memory concentration skills, so that they can attend to the particular problem at hand and then move on to the next. This "living in the now" is something trainees also must learn, as the following controller discusses.

R: By nature of the job, the job that you sit in front of and you do for the moment. And it is forgotten in ... Five minutes later someone could give you a call sign and you wouldn't even know who it was, and yet for a minute or two that you controlled that aircraft and have 300 lives on board and your heart was thumping and you did all the right things — But five minutes later you won't even know what his call sign is. Just in and out (Int. 92, Trainee, Approach, Perth).

The time pressures, intensity of work and short-term duration of the work flow mean that the controller must be aware of his or her limitations, since the work can get too busy for one person to handle and before this occurs a decision must be taken to "split" the sector up into smaller spaces - this is particularly the case in the larger Enroute areas. Thus, the build up in the rate of work flow also must be monitored.

7.2.1.1 Using artefacts to monitor the temporal dimension of the work

Theorists involved with distributed cognition emphasise the ways in which objects and displays function to support collaborative mental work (see Hutchins & Klausen 1996; Pea 1993). A number of strategies are used to monitor the temporal dimension of the work by individuals and groups and these strategies involve a range of artefacts. As the quotes earlier have illustrated, controllers use the lights flashing on their consoles as indicators of their performance in relation to the ebb and flow of the work. These cues allow controllers to monitor the work and to anticipate when extra help may be needed before the situation becomes too busy.

In ATC, the temporal experience of work intersects with the social experience (see Table 15) as air traffic controllers use shared spaces and shared objects like the paper strip to monitor the flow of traffic (see Chapter Five and Appendix 8). Shared objects and displays facilitate the process of what Resnick (1993, p. 10) calls "referential anchoring". In ATC work the visibility of workload on other sectors enables controllers to referentially anchor their work in relation to what can be anticipated. For example, the build up of paper strips on a neighbouring console provides a common referent that can be used by controllers to monitor what work is building up that is likely to be coming their way.

Because the information about the activity of work is publicly available, team leaders and colleagues can also anticipate when a controller working at the console is likely to need help.

7.2.1.2 Using the body as an artefact to aid performance

Joas (1996) contends that most theories of action overlook the role of the body and are based on an implicit assumption that “the body is the factual basis of action but pay no attention to it, as if in a fit of theoretical prudishness” (p. 167). Joas (1996) goes on to argue that the role of the corporeal body in action deserves greater attention. In this Thesis, it is contended that controllers use not only tools and shared objects to monitor and aid performance but also use their bodies to referentially anchor the temporal dimension of the work experience. A controller uses his or her own body to monitor performance and to determine whether he or she is getting overloaded, as the following controller explains.

I: How do you know you’re getting close to the edge?

R: Personally? I start to perspire basically, that will be one of the major indications - I’ll start feeling hot. I think you’ll find a number of people will say the same thing. I notice a couple of the girls - if you walk in and they’re red in the face you know they’re starting to push it - that’s a physical sign. Another physical sign is you’ll notice that you’re not saying call signs quite as well because you’re trying to say them too quickly. Little things like that - that should be ringing bells in your head. Either that it’s time to get out or it’s time to get someone else in (Int. 58, Controller, Enroute, Melbourne).

This quote highlights how the controller uses his body to monitor his workload. It is contended that the use of the body in this way is a mechanism to manage work in a temporally-based and intensive environment. Controllers also use their bodies to aid performance. In the interviews, controllers would talk about developing their own “body-clocks” — to know when an aircraft is due to call, and when that moment has passed (and thus when remedial search and rescue action might be needed). In accredited on-the-job training, body-clock development represents an indicator of the controller’s emerging understanding of the temporal flow of the work (see both Table 14 and Table 15), as the controller begins to build up the skills required for expertise and accompanying automaticity. Instructors look for trainee anticipation of when something should happen as evidence of progress in body-clock development. Being surprised by a call indicates a lack of awareness of the air traffic situation and is evidence of poor body-clock development. In simulator training, instructors have been known to “ruin” time clocks so that the trainee builds up their own body-clock.

Controllers use also other parts of their bodies as aids in performance. The intersection between the temporal and affective dimension of experience (see Table 15) requires controllers to know when they are getting to the edge of their limitations and to use the voice to display confidence. Controllers discipline their voice, for example, to sound calm and confident and thus to project authority and control into a situation. This is one of the first things a trainee must learn. Sounding confident is important because it has an impact on the operation of the entire system. In the following excerpt, the

respondent has been called on by a colleague to assist a trainee to overcome her lack of confidence. In doing so, he explains the impact a lack of confidence will have on the controller's workload.

I: So he (the instructor) came to you for your assistance (with the trainee)?

R: / We told her that it doesn't matter if that isn't exactly what you think is the perfect thing to do. If it is safe, be confident in it and do it, because if you hesitate, then things will get worse. / You've got to be confident in your memory, what you remember, how you approach things. You've got to achieve the pilot's confidence straight away. He doesn't give you a second chance. If you do something and he feels..., like... He's... putting his life in your hands, and if your confidence isn't there, or he doesn't feel it's there, then he's going to be nervous. And that's going to make things more difficult, because he's going to want to know more information, then you're going to get further behind, and it steam-rolls itself. So if you're not confident, those around you and those you speak to will hear it and you'll undermine yourself, and your confidence gets worse. It's a difficult time for somebody who's been away, or someone who's had an incident, or who's newly rated, to sound confident. especially for some of the younger trainees, because they sound so young (Int. 121, Instructor, Enroute, Melbourne).

Controllers must be confident in their own decisions so that they can move on to the next problem and they must communicate confidence to others. However, with the cultivation of confidence must also come a cultivation of doubt, as controllers need to maintain vigilance against what they call a "fat, dumb and happy" attitude of complacency. This is a balance between overconfidence and cautiousness. Controllers, therefore, need to be both confident in their decisions as well as constantly checking and scanning the situation to notice unanticipated disturbances. This involves having both temporal and cognitive awareness of the situation (see Table 15) as controllers require skills in concentration and vigilance. Over-confident controllers can make a mistake because something is not checked and under-confident controllers can make a mistake because they undermine their performance. Lack of personal and inter-personal confidence will create problems because it will create extra work and as a consequence lead to performance decline.

7.2.2 The complexity of ATC work

In ATC work, decisions are made, changed and remade as information becomes available. The work requires combinations of anticipation, planning and decision making as various problem permutations become available (see Chapter Four and Appendix 8 for a fuller description of the kinds of problems that present themselves). Like all service work, because of the combinations of options and potential problems, the work is constantly changing and one day is never the same as another. The nature of service work is such that a task or situation will rarely have the same combinations of features a second time as is evident in the following quotation.

R: You might come to work one Friday, and everybody gets away on time. They all cruise along, weather's fine, no turbulence. You go home and think '*did I actually go to work today?*'

Nothing happened! And the next Friday, you expect the same scenario but two are late, one's early, and one's on time. And they're all in a clump. And the weather's bad, and you've got four aircraft and you have to sort it out. You can't simulate the way it happens in The Room (Int. 121, Controller, Enroute, Melbourne).

Controllers operating in this work environment must be open to variability and act responsively and flexibly (see Table 15) in working through the permutations that occur as part of the "routine trouble" (Suchman 1996) encountered within the work activity. They need to build a holistic understanding of the air traffic pattern, relating the individual problems back to the whole. Development of these skills are supported by psychological theories of expertise.

7.2.2.1 Gaining "the picture": Using artefacts to aid in visualisation

Research into ATC expertise (e.g., Issac 1994) suggests that controllers maintain a mental air traffic three-dimensional "picture" which is a visual representation of the air traffic pattern at any one time. Controllers check the accuracy of their visualisation of the air traffic flow (particularly in procedural non-radar sectors) by anticipating when aircraft travelling in opposite directions will sight and pass another. To check this they will request the pilot to notify the controller at the exact time this occurred (having already prepared an estimate of when the event will occur). The use of imagery has been investigated also for its role in maintaining situation awareness (e.g., Endsley 1994; Issac 1994). However, it is contended in this Thesis that controllers also extend their use of visualisation to incorporate their manipulation of the tools they use in undertaking the work. They do this by beginning to represent parts of the airspace with parts of the console. This enables them to maintain a visualisation of the airspace and to prioritise their work, as the following instructor explains.

I: So you're working out where it [the aircraft] is coming from?

R: It wasn't long before I realised you could preempt a whole lot of things, just simply by mental imagery / each button [on the console] the realisation was eventually, that each button reflected a particular block of air-space there. As soon as that light flashed, you mentally thought, '*North west*' / Or '*block south-west*'. And not only did you identify the block of airspace, but by looking at the strips you were holding there, you could predetermine, to an extent, what was going to come. So you're already turning things inside out. If the call was from [from a particular airspace sector] as you're about to answer it, you're looking at your own outbound track to see what you've got / You're making and predetermining / At the same time, [another airspace sector] rings, but, you're not holding any strips on anything from [that sector], so straight away, you take the call that you've got strip-work for When you do eventually take [the other call], they might be asking you for a footy score or '*have you seen Jack or Fred*' or '*What's Bill doing these days?*' (Int. 47, Instructor, Training Annexe, Melbourne).

Nevertheless, together with the temporal experience of the work, there is a rhythm to the work and new controllers build up their experience of routine trouble as well as gaining experience in non-routine trouble over time, as the following controller explains.

By the time you see the words coming out right, you are also looking at how late they pick up that the order has gone wrong. So, with an inbound bunch, they are coming on to the screen. Generally they come on in the right order and everything works. Sometimes it has gone wrong and you actually literally have to change round what has been flowing. A rated bloke will pick it as soon as he comes on. He will just look at it and say '*Oh, this doesn't look right*'. / whereas a trainee first out, doesn't even see it. He just sticks with what the paperwork says and he makes it work. He works the daylight out of himself to make it work. He doesn't think about changing it. You always look for that progression with the inbounds that when they start to realise '*Oh, this will be easier if I do it this way*'. They are starting to see the overall picture/ After a while they start to get on top of it and you see this happen and then the final stage when they get on top of things is when they get all the rats and mice (low flying general aviation aircraft) in at the same time and they are just ... they don't get fazed by blokes who say '*Oh, I want to overfly Brisbane at 2,000 feet*' while he is as busy as anything. They just let it go. Technically, they don't get in the way most of the time. They can do it. Otherwise they will pick the one that is going to be a problem and just say '*No, send him somewhere else*'. That often doesn't even come by the time they are trained (Int. 68, Instructor, Approach, Brisbane).

In this case the trainee controller described by the instructor has developed the appropriate phraseology to use and has begun to recognise the various combinations of problems that are presented in routine work. The kind of pattern recognition described in the quote leads to an increase in the controller's capacities to correctly identify and solve the problem by changing the work around. However, as also indicated in the quote, managing this kind of complexity only occurs over time and is sometimes not fully mastered by the end of training. This too indicates the length of time needed (listed as "longevity") in ATC work to build up expertise, as controllers need time to gain experience and practice in a range of problem permutations. These findings support research into differences between novices and experts (e.g., Benner et al. 1996; Chi et al. 1988). Benner et al., for example, concluded that novices typically engage in rule-based behaviour, and in the case of ATC trainees (indicated in the quotation above), do not question the rules. Experts, on the other hand, typically use patterns and their own maxims, developed through experience, to guide problem identification, prioritisation and action.

7.2.3 The affective experience of ATC work

Boud and Miller (1996) claim that "the affective experience of learners is probably the most powerful determinant of learning of all kinds" (p. 17). While this appears to move beyond empirical data, in this Thesis it is argued that affective experience is significant for all people engaged in productive activity, not just for those who are engaged in activities traditionally defined as learning. This is because as Donaldson (1992, p. 12 in Boud & Miller 1996, p. 17) suggests, we "experience emotion only in regard

to that which matters". In ATC, the temporal experience of work and the significant decisions made as part of the work have already given rise to physiological arousal (see Table 15) experienced by most controllers, generally in the form of perceived increases in adrenalin during busy periods. Psychological arousal also is present as affect because the decisions made involve the self and are about issues that matter. Moreover, as was discussed earlier in this Chapter and in Chapter Five, the display of affect plays an important role in the success or otherwise of the controller's performance.

7.2.3.1 Affect and performance: Presentation of the confident self

It is contended that there is a direct relationship between one's performance and one's affect. Affect is evidenced in an individual's feelings, emotions and moods (Fiske & Taylor 1991). In temporally demanding and complex work, where decisions made are significant and publicly available to others, affect plays a key role in enhancing or inhibiting the level of performance. As was discussed within the temporal experience of work, controllers discipline their voices to project confidence because a positive affect is necessary to maintain optimum work flow and to minimise effort. Detection of negative affect will lead to expressions of doubt about the controller's decisions which will lead to a greater workload and a diminishing of confidence and thus performance. In ATC the affective dimension of experience can be identified in the ways in which people talk about their confidence in what they are doing. As discussed in Chapter Five, confidence is collectively held to be a necessary, though not sufficient, element of good performance. A good controller is capable in their performance and confident in their belief in their own capacity to do the job.

I: Confidence is the crux isn't it?

R: Once you lose your confidence that's the end of you. You've got to be confident (Int. 83, Trainee, Approach, Perth).

For Bandura (1997), affective processes are at the heart of theories of self-efficacy and control. "Perceived self-efficacy refers to beliefs in one's capabilities to organise and execute the courses of action required to manage prospective situations" (Bandura 1997, p. 2). Having confidence, in one's own capability to perform under certain conditions and using this as a tool to ease work flow is used in ATC as part of impression management (Goffman, 1960). Furthermore, confident people believe in their own agency and keep trying - a necessary quality in work involving the dimensions of sociality, temporality and complexity. Affect, therefore, plays a key role in the smooth and efficient handling of the ATC system.

It is contended that there is a curvilinear relationship between the affective experience of ATC work and performance, as the following team leader explains:

I: What's the role of confidence?

R: I've got one controller who is a real confidence player. If he's down on confidence, we've got to keep a real close eye on him because he's just, so hopeless, we have lots of problems with him. If his confidence is up, not a problem in the world, away he goes. So we have to

keep a careful eye on his confidence and how he's going along. When he's training, we have to very careful (Int. 113, Team Leader, Enroute, Melbourne).

For this controller his level of confidence directly affects his performance. When lacking in confidence the controller is likely to make more mistakes. In ATC work affective experience requires an individual to take certain things for granted - to have confidence and trust in others, in the equipment, in one's own decisions. A certain level of vigilance and checking are necessary to avoid complacency and thus a mistake. Too much checking and doubt, however, not only slows the performance down but is likely to lead to more mistakes. Feeling comfortable, somewhat relaxed and confident in one's own decisions enables the controller to operate with a certain level of automaticity and to potentially make more difficult decisions that enable the work to flow more smoothly.

Erving Goffman (1960) regarded behaviour in everyday life as a performance, with many similarities to theatrical performances. In Goffman's terms, the main objective in impression management is to sustain a particular definition of the situation, that is, to behave in a certain way that makes an implicit statement about what is real and important in this interaction (Guirdham 1990). The impression of confidence needs to be conveyed to gain the confidence of others. Establishing an impression about one's confidence thus becomes part of one's self projected to others in The Room — that is, that the controller is confident and thus capable. Conveying confidence as part of impression management will be discussed further in Chapter Nine, where it will be shown that believing that one's role includes the presentation of a confident self limits inquiry and thus both informal and accredited learning.

7.2.3.2 Work as expression of the self

It is contended that all work involves to some extent the expression of the self. For those who find their work meaningful and enjoyable, the result is job satisfaction and for others, the opposite, work is alienation. ATC work involves the interpretation of symbols and other information. In these circumstances, work satisfaction comes from the controller's own performance within what can only be described as a highly regulated system. The following controller describes what he enjoys about his work.

R: It's a big puzzle, coming up with solutions. Like it's really busy and you get stuff, you get a bit of adrenalin, because you're working really hard, and you're coming up with these amazing [solutions]. You're juggling him 15 miles and you're putting them into trails and you come up with a solution. You get this guy up to his level quickly, and you've got him down and it just runs, it's really busy and everything just runs perfectly, because of the decisions you're making (Int. 113, Team Leader, Enroute, Melbourne).

"Good" controlling is not just controlling aircraft safely and expeditiously, but with "finesse". It comes from solving traffic problems quickly and easily — with elegance. Controllers gain an aesthetic pleasure from deriving an elegant solution. "*Because a smoothly operating traffic flow is a beautiful thing*" (Int. 64, Instructor, Training Annex, location withheld). For controllers, the satisfaction comes from their

performance, from undertaking the work fast (expeditiously) and from making decisions that impact upon the air traffic system. However, the impact of an individual's contribution on the ATC system is brief, as the following controller describes.

R: You come to work, you clock-on in the morning and you do your job. / When you sign off you're no longer responsible, you're no longer active. There's no work to take home. There will be incidents that happen that aren't reported where you know you performed less than your best and they will worry you after the event. But in general if you are still worrying about any aspect of the job when you drive into the driveway after driving home from work, then the job is starting to get to you and you need to modify your behaviour to adjust accordingly. Because any event that was happening or that you had a part in has come to a conclusion by now, well and truly. Within 10 minutes of walking out the door. And it is either resolved satisfactorily or you'll read about it in the paper. And it's as simple as that. There is nothing you can do. The event had a time life of 10 minutes or a half life almost. Because the impact of your effects on a system are very much like rapidly decaying radioactive material. So if you had something to do with it, then 10 minutes later it might still be critical if you're on a procedural sector. If you're doing Approach in Perth, a jet has come from 30 miles and landed. So he either managed to land or he didn't. And that's end of story (Int. 18, Controller, Approach, Perth).

For many controllers this lack of continuity of work is regarded as an asset: they describe the amount of money they earn and how they do not take their work home with them. For others it seems that this lack of meaningful involvement leads to channeling their energies elsewhere. Many controllers have second jobs or interests external to their work. The need to disengage from one's work, to separate one's self from the intensity of that work would seem to be a feature of High-3 environments. In discussions conducted with ambulance personnel for example, the same desires are found. The "system" marches on. As work increases in intensity (see again Chapter One) the capability to shut off would seem an important means of reducing the possibility of stress and burnout (Dell'Erba et al. 1994).

7.2.3.3 Invisibility of knowledge work and the valuing of performance

When the input into one's work is intense and the output is not easily visible (as is the case with many jobs involving knowledge work), means of assessing one's contribution of work quality need to be found by the worker. The fleeting evidence of the controller's affect on the system, leads some controllers to question the contribution that they make with their work and it leads others to look for other means of valuing their input into the ATC system. It should be remembered that no individual controller is responsible for an aircraft from departure to landing (although this used to be the case for controllers operating General Aviation Towers, where private pilots would come and fly for a few hours, departing and landing at the same airport). Even controllers responsible for ensuring an aircraft lands safely have only had the aircraft as part of their responsibility for the final five to six minutes of flight. Although one would expect that controllers would perceive that their work provides a

meaningful contribution to society (ensuring lives are not lost), the invisibility of the work results in some controllers believing that their work is not noticed and that they receive little recognition for their work, that is, unless something goes wrong. The following controller discusses his feelings about his work when he begins and ends a shift.

R: You plug in, start with nothing, plug out, end with nothing. You know, '*what did I do?*' That's where you could feel guilty about the money that you earn, because you think '*oh, I don't produce anything*' / . "Social contribution?" . Hmmm [respondent was reading off 'characteristics of good work' sheet - see Appendix 2].

I: Well, it [ATC work] certainly does that — saving lives is pretty important.

R: Well, that's the interesting part. Like people say '*oh, saving lives*'. We don't actually save lives, you know? Like some people think that they do '*oh, gees, I'm so good, I've helped these people out, they didn't die*' And I think, it's more protecting them, than saving them, you know? / I mean it doesn't, — we're there to provide a job, but it's not, — we're not ambulance officers. We don't go and revive people. We're there to provide a service. In aviation, when it runs well, it's well. But when things go wrong, they go terribly wrong (Int. 101, Controller, Enroute, Melbourne).

For the controller above and others like him, his work involves making sure the symbols or dots on a radar screen never touch each other. For some controllers the satisfaction they enjoy from their work involves their level of performance within the ATC system: at how fast and hard they can undertake their work. The valuing of a high level of performance and its display, however, has led to a particular culture of ATC that has been identified by management and the industry as needing to change. As early as 1992, in a review of air safety incidents occurring within Australia (see Chapter Four) Ratner (1992) concluded that:

ATS [Air Traffic Services] officers take considerable and justifiable pride in their work and in the quality of their performance. Unfortunately, the predominant measures they are using today are (1) how few breakdowns of separation, or close calls, they have had; (2) how much traffic they can handle; and (3) how often they can accommodate requests for direct clearances and desired altitudes (p. 38).

Structural changes associated with the implementation of STARS (see Chapter Five and Appendix 8) have been introduced to regulate the decisions controllers can make in undertaking their work. This has resulted in such changes being regarded as deskilling by controllers, particularly those directly affected by the change (such as Approach control).

I: What is it about it [your work] that is satisfying? Or what is it about it that gets frustrating?

R: The satisfaction is in getting a mess of aeroplanes in a string and putting them in a nice little chain and playing with them. It is a skill thing basically. It is a joy in having the skill and being able to do something like that I guess and recognise that there is a sort of certain elitism about

it. This is why it is so hard. Every Approach controller is the same, some more so. That's why it is hard to change the culture. '*We have got to slow things down*' and all the rest of it. Because everyone gets a buzz out of doing it and doing it well. When you start nudging into someone's good feelings about the job because you have pushed through a lot of aeroplanes, because [what] you are forcing him to do is back off, that is why you are getting all the deep resentment. I can understand it because every controller has been there, it is just that we are all there at different degrees (Int. 86, Quality Assurance Officer, location withheld).

Moving aircraft quickly is valued in all sectors, in some more so than in others (e.g., Approach) where one of the structural elements of the organisation of the work involves the time aircraft spent in each sector. The valuing of a high level of performance is shared throughout Centres and sectors and thus collectively held is part of the organisational culture. The portrayal of a social identity based on the display of performance will be further discussed in Chapter Nine.

In ATC, like other service industries, where work performed is a service, satisfaction comes, not from being able to view a tangible product, but from the act of performance involved in the work (Orr 1996). Therefore, a balance needs to be found between being psychologically involved in the importance of one's work but not to the extent that one worries too much about the decisions being taken, and conversely, not to become so detached that one sees the dots on the radar screen as something akin to a pinball game (see Chapter Five). Managing the psychological self, therefore, becomes an important aspect of work performance.

7.2.4 The social experience of ATC work

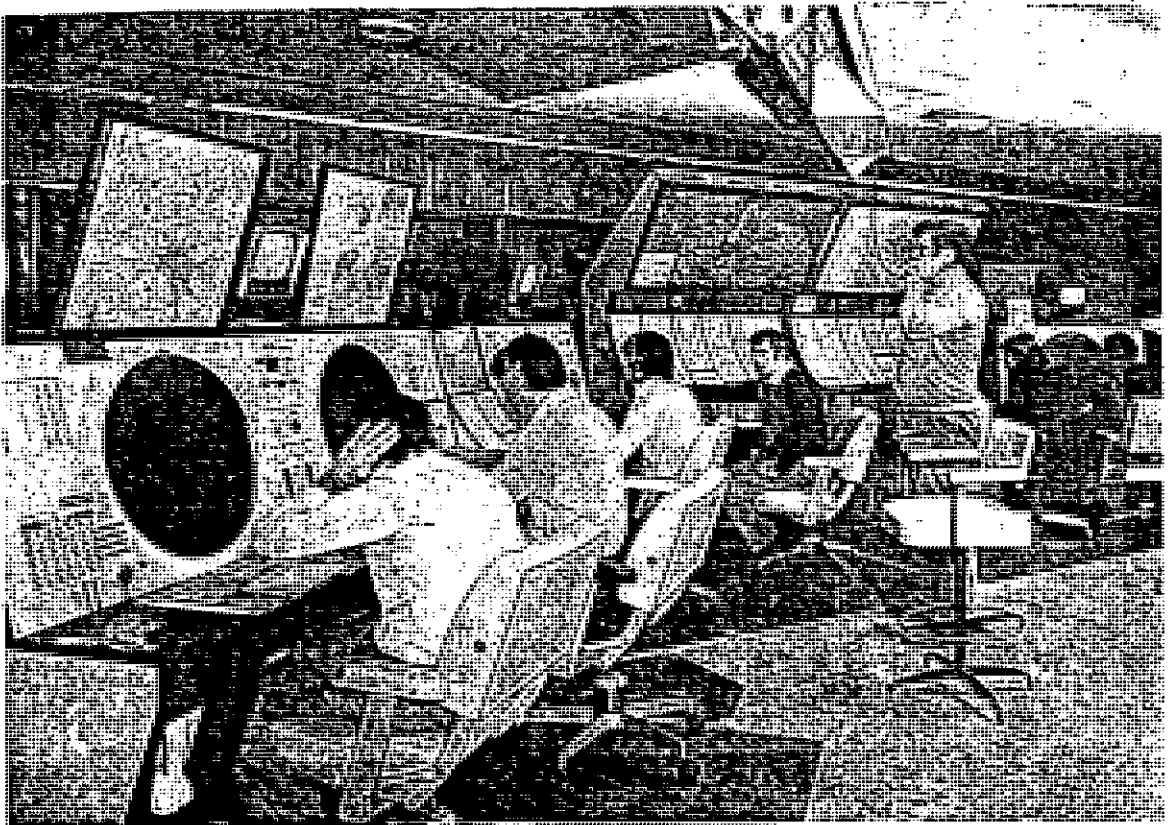
As discussed, the complexity of the air traffic system means that no single individual is fully responsible for the entire duration of a flight. Controllers must work together and with others (e.g., pilots) to ensure the flight proceeds safely and expeditiously. Herein lies one of the paradoxical qualities of the nature of the work. On the one hand, one controller is ultimately accountable for his or her actions. The focus in performance terms (and in learning for that matter) is on the individual. Controllers are expected "to take charge" of a situation, to "take command" (Int. 47, Instructor, Training Annex, Melbourne). This leads many to feel that it is a highly individualistic job. For example, "You are responsible, you will do it" (source: Int. 51, Controller, Enroute, Melbourne). On the other hand, ATC is essentially a collaborative activity despite the work being designed to minimise the need for explicit coordination and cooperation between controllers. The controller negotiates, confers, discusses and on the basis of this information, plans and acts. The performance of one controller influences the performance of another, and indeed, the performance of the entire air traffic system is influenced in this way.

Chapter Five introduced the notion of how the work was spatially organised. Although sitting at consoles with their backs to the room, controllers have an awareness of other traffic and of controller's operational styles by virtue of their physical presence (by being adjacent to a console) or by being able to view another controller's airspace on the radar screen. Each controller's actions are inter-dependent

on others in the system and further those actions are responsive to continuously changing and dynamic conditions. Controllers can make work easy or difficult for the next controller by the way they hand off aircraft. Successful collaboration means being able to understand the requirements of the controller operating the adjacent sector such that the work undertaken by one controller flows smoothly into the work of the next controller taking responsibility for the flight. Controllers attempt to learn the controlling style of others they might be working with or adjacent to, so that they can know who they can trust and who they need to watch; (i.e., those controllers who might hand off an aircraft that might be close to losing separation in the receiving controller's airspace -see Appendix 8).

Figure 16 is a useful representation of the proximity of controllers working alongside one another and the ways in which controllers can view the consoles of others close to them. The Figure reveals

Figure 16: The sociality of ATC work



people working and people watching. Those watching are not idle, they are monitoring the situation in a neighbouring airspace. The person standing using the telephone, may be taking or placing a call from or to another agent involved in the traffic scenario building up on the screen of the person in front of him. Being able to observe the work of others is important in high reliability organisations (Maurino et al. 1995), as it builds in a level of redundancy into the system. Socially distributed conditions of work are particularly important in High-3 workplaces because “multiple actors in a system may also provide

redundancy — backups for one another and checks on each other — that often are crucial for detecting errors and correcting them in timely ways” (Resnick 1993, p. 2).

7.2.4.1 Synchronising work: Interdependence and the body

Just as the body is used as a resource when work is temporally and complexly demanding, the body is used also as a means of working in relationship with others in The Room. Some controllers reported that they enter The Room earlier than necessary to commence their shift to get “*a feel*” for how the work activity is going on that particular day. This enables the controller to get “*in sync*” with the traffic prior to commencing duties, and to pick up on the environmental conditions mediating the flow at that time. When controllers commence duty they plug in their headset at the console. Some controllers speak of “plugging in” to the system as if they are “plugging in” to the sociality or interdependence of the work — that is, that once “plugged in” they work, not so much as an independent body, but rather as one connected interdependently to others working the system at that point in time. Part of the sociality of this work involves controllers developing what they describe as a “third ear” that is, they develop their capacity to undertake their work and listen out for what is happening around them. The controller in the following transcript describes the role of the “third ear” in a smaller Centre.

I: So you’ve told that aircraft to call and you’re waiting to see...

R: You can hear everything happening in The Room at the time. You’ve got one ear listening to the traffic and one ear listening to adjacent consoles. And the way you use that in an ATC situation is because you’re hearing if your transfer to that person has gone through or not. Once you know it’s gone through you can ditch your information on that aeroplane, You’re not using hot line, you’re not using frequency, you’re listening to hear Jack go *giddy Alpha Bravo Charlie, descend to flight level 7000*’ (Int. 47, Instructor, Training Annexe, Melbourne).

The third ear becomes an important resource for synchronising temporally and complexly demanding work when working interdependently.

7.2.4.2 Synchronising work through continuity of experience

Teams too provide a continuity of shared experience. Working with the same group enables a continuity of experience to be built up over time allowing these experiences to be shared and for people to begin to know each other’s preferences for working, thereby enabling individuals to anticipate the needs or work practices of another. The following controller talks about the valuable roles his team-members play in everyday work:

They will relieve the person of all the little things. It might involve keeping an eye on two particular aircraft while that person is looking at another couple of aircraft. It might be writing a time on a strip which is not operationally critical, but it is part of the job we need to do for stats, and to relieve that person of that little bit extra that that person [inaudible] part of that job. Just to know that somebody else is doing it. It might be moving a strip, it might be a

nudge on the shoulder at the right time to say [something] (Int. 76, Controller, Tower, Brisbane).

7.2.5 Interdependent sentience

The social experience of work involving aspects such as the third ear, synchronising work and public availability of work, in an environment governed by temporality, complexity and affectivity, lead to a quality important in the collective accomplishment of work that is called in this Thesis "interdependent sentience". Interdependent sentience involves the quality of having an awareness not just of one's own performance, but of the performance of those working in nearby sectors and of the relationship between those aspects and the air traffic system as a whole. Sentience is present because controllers use all of their senses to gain awareness within interdependent work. The social experience of work involves also an implicit knowing of who is going to be requesting what information. For example, when controllers work a sector together (as happens when the work gets busy) this work is regarded as being performed well when each controller can anticipate the other's requirements to the extent that no explicit requests for information are needed. One can imagine similar situations in other settings reliant on close team-work, such as emergency services, hospital surgery teams and fire fighting. It is contended that interdependent sentience is found in many work settings and particularly in work involving time pressure and imperfect information, as Hughes, Randall and Shapiro (1992) suggested when they discuss the social organisation of ATC work.

The orientation of the individual within the social organization of the work is not primarily to the work as a whole, but rather to the tissue of connections and separations as they fan out from the particular position which s/he occupies.... Though often involving extremes of skill, judgement and coordination, and thus intensive 'work', its smooth accomplishment can render the working division of labour silent and virtually invisible (p. 117).

Interdependent sentience is important in High-3 work, as it is one of the elements that gives High-3 work its reliability, or as Hughes et al. (1992) argue, its "trustability".

Taken as a whole, the system is trustable and reliable.... Yet if one looks to see what constitutes this reliability, it cannot be found in any single element of the system. It is certainly not found in the equipment.... Nor is it to be found in the rules and procedures, which are a resource for safe operation but which can never cover every circumstance and condition. Nor is it to be found in the personnel who, though very highly skilled, motivated and dedicated, are as prone as people everywhere to human error. Rather, we believe it is to be found in the cooperative activities of controllers across the "totality" of the system, and in particular in the way that it enforces the active engagement of controllers, chiefs and assistants with the material which they are using and with each other. This constitutes a continuing check on their own work and a cross-check on that of others (Hughes et al. 1992, p. 119).

The sociality and interdependence of the work is a key feature of ATC work in Australia and of work undertaken in other High-3 work environments and is thus a reason why strategies to enhance continuous inquiry is crucial in enhancing reliability in the work system.

7.3 Conclusion

The Chapter has focused on the ways in which experience is shaped by organisational structures. It has reviewed the practice of ATC work and its implications for structuring work experience in certain ways. It has found that ATC work is experienced temporally, complexly affectively and socially. ATC work occurs within a “real-time” dynamic work environment and as such cannot be stopped. This means that the work is sometimes very intense and controllers utilise many resources to monitor and undertake the work, including their bodies and organisational artefacts. The work involves combinations of decision making that attempt to maximise traffic flow. The temporal and social nature of ATC work experience means that controllers on some sectors need to spend considerable amounts of time to develop expertise in routine and non-routine trouble. The work is experienced affectively, one’s affect influences one’s performance (and thus the performance of others). A confident controller will make decisions and act in ways that enable a smooth work pattern to be developed. An under-confident controller can create more work for themselves because that lack of confidence is picked up socially resulting in others (pilots, controllers) demanding more information. This in turn can lead the controller to doubt his or her own capability which in turn can diminish performance. ATC work is also experienced interdependently - each controller’s actions are interdependent on others in the system and are influenced by others’ actions. The Chapter has described the ways in which work is physically organised shapes experience in many ways. In ATC the structuring of experience as a result of work organisation creates environments that are temporally and complexly demanding, involve investment of the psychological self and occurs interdependently. The next Chapter will discuss the ways in which structures and cultures combine to provide opportunities to make the transition between experience and reflection and thus to begin the process of learning.

Chapter 8

Reflection and ATC work

The means by which contexts influence reflection in accredited and informal workplace learning is the focus of this Chapter. The Chapter shows how organisational structures enable and constrain opportunities for reflection within work practice. For example structures that create temporally and complexly demanding work environments inhibit reflection by delaying opportunities for doing so, whereas other structures enhance reflection through, for example, undertaking different work roles. Cultures too are implicated in processes of workplace reflection and reveal ways by which individuals and groups engage in social practices that generate and transfer collective memory.

8.1 Introduction

The last Chapter presented the ways in which experiences are shaped by contexts (in the form of organisational structures) and how these workplace structures influence the experience of ATC work. The chapter argued that ATC work is experienced temporally, cognitively, affectively and socially. This Chapter:

- focuses on the ways in which contexts influence the process of reflection in both accredited and informal learning; and
- identifies those elements of context that enable and constrain the process of reflection.

The process of reflection involves awareness of an experience and the focusing on or attending to its salient features. Mason (1993) described this as “noticing” and Kolb (1984) as “observing”. Labelling is part of the process of noticing or observing and enables later interpretation and sense-making of observations and experiences (the process of conceptualisation is discussed in the next Chapter). Labelling assists in identifying the features of the experience so that they may be useful in the future because they assist in triggering recollection or memory. The conceptualisation process begins when the labels we apply in making sense of the experience (or the data available) begin to fit within a matrix of meaning. The noticing of patterns can sometimes occur at a sub-conscious level initially (Kolb called this “apprehension”, or “grasping”), later being fully articulated in words. A particular action, or practice may start to work, may “feel right” and then later the pattern can be recognised, described and generalised to alternative situations (when it has been “comprehended” as part of the conceptualising process).

Reflection occurs when people, either individually or in groups, ask themselves questions such as “what is going on here?” and “why did this happen?” Reflection occurs socially when people communicate their thoughts and inquiries in relation to these questions to one another. In Chapter Six it was contended that reflection occurs in cultures through the process of narration and it can also be embedded formally in work structures, such as job roles and tasks. Reflection is constrained when such structures block opportunities for reflective activity to occur.

Culturally, the outcomes of reflective processes are generated and shared when, for example, people tell stories. The aim in environments requiring continuous inquiry is to make reflection an intentional, active and constant process for both individuals and groups. This Chapter will discuss the influence of contexts on enabling and constraining reflection as part of both informal and formal learning activity.

8.2 Attributes of reflection in the experience of ATC work

The way work is organised impacts on reflection in many ways and some examples are presented in Table 16. The dimensions of experience identified in Chapter Seven provide the basis of the Table. In relation to these dimensions of experience, the various structures (S) and cultures (C) that influence opportunities for reflection are also outlined as well as how these structures and

cultures influence the process of reflection. The following section will outline briefly some of the ways in which the experience of work enables and constrains the process of reflection, using examples from both accredited and informal learning in the ATC workplace.

Table 16: Dimensions of experience in ATC work and opportunities for reflection.

DIMENSION OF EXPERIENCE	OPPORTUNITIES FOR REFLECTION (S= STRUCTURE, C= CULTURE)	ATTRIBUTES OF REFLECTION IN ATC WORK
Temporal	Intensity and physical work structure inhibits reflection at work (S) Role differentiation enhances opportunities for reflection (S)	Delayed (rather than immediate) Proximal reflection
Complex	Complex nature of work combined with intensity renders skills opaque - difficult to share reflections of work skill (S)	Opaque/fuzzy Tacit (rather than explicit) Sub-conscious
Affective	Degree of self-efficacy enables or constrains openness to reflection (C)	Surface (reflective avoidance) Deep reflection (dissonance)
Social	Observation of others work; awareness of observation of one's own work (S) Sharing of stories related to work (C)	Peripheral reflection Proximal reflection Individual and Collective reflection

8.2.1 The temporality of experience and reflection

Although there are opportunities for reflection when engaging in work activity, as indicated in Table 16, the temporal intensity of ATC work discussed in the last chapter inhibits opportunities for much reflection at the console. This leads to much reflection being delayed until after work at the console has ceased. This feature of work structure impacts on both informal and accredited learning in the workplace. Its impact on accredited learning is illustrated in the quotation below. Here the instructor wishes to bring something to the attention of the trainee so that the trainee might notice and attend to it, though the temporally demanding nature of the work makes this instructional practice difficult.

I: So what would you have liked to have addressed [in the OJTI course]?

R: / Um, I guess it's a matter of, you've got to make a judgement, how far to, at what stage do you interrupt their train of thought, when they're busy and they're working, you may want to point out something, but they're just a little too busy to take it in anyway. So perhaps it's best to leave it 'til later — but then, you may want to point something out — something is just about to go wrong. Not drastically but they're about to learn a lesson. Something is about to happen. And you'd like to point out that what they're doing is going to occur and all of a sudden — yes, there it does [happen]— in front of

them and [if you've mentioned it] it's sort of reinforced. So it's, when do you interrupt, [and] how far you go? (Int. 53, Instructor, Enroute, Melbourne).

In the example above, the desire of the instructor to bring to the attention of the trainee something that they can notice and thus learn from, is inhibited by the temporal experience of the work. In the following case, the temporal dimension of the work limits the reflection the trainee can engage in, both at the console and afterwards.

I: So the purpose of them [mistakes] is to provide enough experience to find the holes [in their understanding]?

R: Yes, and that is one thing that is different [on Approach] / Approach just seems to go on and on and on at times and you haven't got that opportunity to break it up into parts and work out what's happened and what is done. [Name of Instructor] tries to give me debriefs after two hours and he says '*Oh, you did this with this one and this with that one. What were you thinking then?*' Literally you can't remember the situation at times because it has been two hours and there has been a lot of water that has gone under the bridge (Int. 93, Approach Trainee, Perth).

The intensity of work, combined with the work's complexity, in terms of the number of decisions that have been made during a work segment, can make reflection on experience for learning difficult for both the instructor and the trainee. Breaks are taken at the end of a two hour period, but the trainee finds it difficult to recall the exact scenarios the instructor wishes to discuss. This difficulty will be encountered in any other on-the-job training situation where the work is temporally demanding and involves complexity. Such situations abound in high reliability organisations (e.g., firefighting, mining, the stock-exchange, surgery), though they are not limited to them. It is argued that similar attributes apply to work in a range of settings, for example, restaurant work, the performing arts, or participating in professional sport.

In these situations greater attention needs to be given to using resources that can enhance reflection following experience, since it is understood that the nature of High-3 work does not allow for the capability of stopping the workflow to reflect and debrief, something that can be done in other training environments, such as the Annexe and the College. Educational technologies that enhance observation, such as video-recording or audio-recording would also enable the instructor and the trainee to re-view a work situation and to discuss at length what the trainee was thinking and planning at key points in time. The use of video as part of observation and teaching has been used in temporally and cognitively demanding tasks with valuable results (see Stevenson 1995). Such reflective strategies could also enable enhancement of instructional skills, as the instructor needs to be able to develop the appropriate communication skills to convey his or her own understanding of the emerging traffic scenario but also to be able to allow the trainee to continue to operate, as the following instructor explains.

The hardest thing at first (when being an instructor) is to be able to concentrate on what is going on. You literally have to teach yourself to actually keep a full picture of what is happening. *'This has to be done now, he didn't do it. I have got to remember that he didn't do it'*. That is the first thing that you have got to teach yourself. That is very hard - being able to keep [a handle on] what is going on (Int. 78, Instructor, Arrivals, Brisbane).

Strategies to recapture the complexity of the experience, such as using video, would enable instructors to reflect on the timing of their intervention and its consequences. Changes would be required, however, in existing cultures of practice, because within those communities of practice reflection is not regarded as a valuable form of work activity and is currently not built into routines. The implications of norms of practice and their inhibition of processes of learning will be more fully discussed in Chapter Nine. Using resources to enhance recall in delayed reflection would, therefore, be useful for both trainee and for instructor development. Use of these resources for learning would need to be supported by other structural resources, such as having appropriate policies where the use of video could only be used for learning purposes and not used for sanctioning mistakes. The implementation of such a strategy would need to involve other stakeholders within the ATC work activity system, such as trade unions.

In ATC work, the physical organisation of the work-space also limits reflection away from the console, as there are few places where one could work, if not at the console.

I: I heard that when people finish their shift, they never go back in The Room.

R: Perhaps there's an element of that - there's a feeling that you're not welcome, not wanted there. When you're not on shift, you're not wanted there. You're in the way and that's true I suppose (Int. 55, Controller, Tower, Melbourne).

The ways in which the physical resources of work organisation are utilised means that there are few physical spaces where people go after their shift to reflect on their work practices, and this influences both accredited and informal learning. There are communal recreation spaces, but the current work-space is designed with the primary goal of air traffic operations in mind and not other forms of related work activity. Currently, there are other work-spaces where controllers may be working in other jobs (such as project development), however, these are physically separated from ATC work by being in other buildings. The way the work is organised and the way that it is performed, therefore, limits the opportunities people have for reflection in their work. Physical work structures need to be designed to take account of primary forms of work activity that may not involve direct "hands on" tasks but may nevertheless be important in enabling work to occur.

8.2.2 The complexity of experience and reflection

Observing and checking, and seeking patterns is a necessary part of work activity, though as discussed in the last chapter, too much deliberative and conscious reflection at the console can

slow work down and create problems because of the temporally demanding nature of the work. However, as discussed, one of the disadvantages of delayed reflection combined with the automaticity required in temporally demanding work environments is that it can make the deliberate and conscious reflection on the skills being utilised opaque even to the controllers directly involved. This is exacerbated by the variability in decision-making processes and tasks undertaken, this makes the process of reflection something that occurs at a sub-conscious and tacit level for the individuals concerned, as the following trainee describes.

I: So I am interested in when people suddenly click and they have it. But nobody can tell me what it is that they have.

R: Yes. The only thing I can compare it with is back in high school when I was studying maths 2/ Going in the progression from algebra and calculus that you had done in Grade 8, Grade 9 and Grade 10 and then in Grade 11 to start talking about three-dimensional planes and matrices which, in hindsight, matrices weren't very difficult. They are quite a simple thing to understand, but for two or three months it just didn't make any sense at all. Then one day you sat there and thought '*That's pretty obvious*'. Something just clicks and you can see it. It is like looking at one of those three-dimensional pictures. For a long time you are looking at this fuzzy, blurry image and then suddenly a three-dimensional bit jumps out and hits you (Int. 77, Trainee, Enroute, Brisbane).

For this trainee the noticing and pattern seeking in understanding the work activity was something that required time and exposure and, quite likely, a lot of seeking and searching on the trainee's part, though this was not something of which the trainee was conscious. Novice-to-expert studies (e.g., Benner et al. 1996; Chi et al. 1988) suggest that typically, pattern seeking occurs in the early stages of the acquisition of expertise, and provide the foundations for holistic understanding of problem solving. Although these studies are of some benefit in accounting for learning in the ATC workplace, greater understanding is needed of the processes trainees engage in when reflecting and attempting to make sense of what appears at first to be, in the words of the trainee above, "*a fuzzy blurry image*". Resources aimed at supporting delayed reflection, such as those discussed above like audio- and video-tape, should assist in this enhancing reflective activity.

Unfortunately, however, reflection and understanding are also inhibited by collectively held beliefs and norms of practice associated with the belief that ATC is based on ability and that the individual either "has it" or does not (See Chapter Five "Culture as an element of organisation"). In the case where the instructor believes that good performance is based on ability and what the trainee needs is simply sufficient exposure to build up their performance base, little attention is given to making the processes of reflection explicit or to assisting the trainee (or instructor) to develop understanding of the cognitive process involved. The following controller describes a

norm of practice that indicates that little time is given to facilitating the process of reflection in on-the-job training.

I: You wouldn't use notes then. What about pre-planning?

R: I don't use notes. No. / We just say "Right, who's turn for a brew?" and sit down and we just start working and we take it from there (Int. 71, Instructor, Arrivals, Brisbane).

This is exacerbated by the structural problems discussed earlier, of having limited work-spaces where controllers can go to discuss training performance, as well as by those cultural norms of work practice that do not attend to the importance of something like reflection. This characteristic of ATC workplace culture will be discussed further in the next chapter. Strategies need to be found to enhance the process of reflection, in both formal and informal learning practice, by making it a more explicit and direct component of work practice. Some of the strategies mentioned above and discussed below (see section 8.3 "Socially reflexive processes at work") would assist in achieving this aim. As will be argued below, where structures such physical organisation result in work that is corporeally and cognitively demanding, and where opportunities for immediate reflection are limited, controllers rely heavily on their affective and social work-experience to judge their performance.

8.2.3 Affective experience and reflection

As discussed in Chapter Seven, the demands of work characterised by intensity and immediacy, risk and reliability require controllers to utilise as many resources as possible. In summary, this includes their corporeal and psychological selves. Just as the body is used to notice controllers' management of the temporal dimension of work experience, the psychological self is also used as a means of reflecting on the work activity. Being confident for example, assists in creating the right conditions for optimal work activity and also signals to other actors in the system, and to the controllers themselves, their capability in the situation. In High-3 work environments it is clearly important that individuals have confidence in their own capabilities and in the capabilities of others and that they engage fully in undertaking the work, without worrying about doing so, as the next controller explains.

I: What about learning your own limits?

R: I think that is the same once you, overall, if you are not comfortable with it, if you keep thinking '*Is this going to fit? Is this going to fit? Is this going to fit? Is this going to fit? Pheuw, it has fitted*'. You are not going to last too long. You have to know that '*yes, it is going to fit*' when they take off and not worry about it. You have got to watch it, but not worry about it. When you know that is going to happen ... that you are at that stage, you don't worry so much about your own limitations or something (Int. 77, Trainee, Tower, Brisbane).

As the above controller indicates, being confident in one's decision and that it will work ("yes it is going to fit") provides the controller with self-assuredness and trust (in oneself). This assists in ensuring the controller does not expend too much energy worrying with the consequence of becoming burnt-out (Dell'Erba et al. 1994). As discussed in the last chapter, confidence needs to be conveyed also to gain the confidence of others. A conclusion that can be reached from the data is that a certain level of watching and monitoring one's own performance and the performance of others is necessary, but introspection and critical questioning need to be left for after the performance of the shift.

As was discussed in Chapter Seven, confidence is sometimes displayed as a means of impression management and its projection can then become part of the controller's persona, part of the social identity projected to others. It will be argued in the next Chapter that the display of confidence and belief about one's capabilities can sometimes inhibit reflection and interpretation because by psychologically investing in the "can do" belief supporting such performance, little time is then spent reflecting and critically questioning ones' own performance.

For others there is engagement in reflection and sometimes this occurs at a very deep level as a result of dissonance. Dissonance occurs when one's performance is not at the level the trainee or controller believes it ought to be and the gap between the ideal and the real performance level leads to considerable psychological discomfort. Critical questioning and deep reflection then occurs, particularly following a jolt or surprise of some kind, typically in the making of a mistake. For trainees, this period of critical reflection is often linked to a phase in training typically referred to as either "the plateau" or "the hole". This can occur approximately two-thirds through the training when the trainee is expected to rely less on the training officer. In this phase of on-the-job training, the trainee begins to question deeply their capacity for doing the job and thus, their identity as a person with competence and confidence is under scrutiny, as the following trainee explains.

I: What were you feeling during those couple of weeks?

R: I was feeling significantly depressed. Not depressed, I don't fortunately suffer from depression much. Once I leave work, go out the gate, everything seems to stop. During those weeks were some of the few times where I had actually gone home thinking about work all the way home and waking up at 2.00 in the morning thinking 'Now how did I do that?'. It wasn't very pleasant at all. I was not sleeping well and not eating well and not feeling well and preparing myself for going back to being in flight data (Int. 71, Trainee, Enroute, Brisbane).

In learning theory terms, dissonance is a key factor in learning (see Brookfield 1993; Ternant & Pogson 1994). However, for dissonance to be stimulus for learning, the learner must have an "internal locus of control" (see Chapter Two) and attribute mistakes to something that can be fixed with effort and the correct strategy. If the trainee in the above quotation believes that he is

not performing well because he does not have the innate ability, then the trainee's confidence will continue to decline and the trainee will be unlikely to be motivated to develop new strategies (see Biggs & Moore, 1994). Collectively held beliefs in the role of ability in determining success or failure illustrate the influence of culture on the process of both reflection and conceptualisation. This will be discussed further in Chapter Nine, where it will be argued that cultural beliefs in ability and performance inhibit reflection and conceptualisation processes.

Many of the interviewees discussed how the dissonance exemplified by the trainee in the above quotation seems to make matters worse because it further undermines performance. Critical reflection can also be blocked if a jolt or dissonance is experienced that threatens a core aspect of one's identity. In ATC the collectively held beliefs about the importance of competence and confidence lead some controllers to engage in impression management aimed at covering up or avoiding reflections of their weaknesses.

You can always pick those people [those who engage in bravado and bluff] because, two or three days after they've had an incident, they're as right as rain (Int. 82, Controller, Arrivals, Perth).

In the quotation above, the respondent notes the different pattern of behaviour displayed by someone engaging in impression management compared to someone who does not. A controller who does not engage in impression management would be shattered by almost having had an accident and would spend a great deal of time critically questioning their behaviour and what lead to such a mistake. Controllers engaging in impression management do not display this form of reflection. It is contended that for controllers engaging in impression management where the dissonance created between actual and desired performance is so great their very identities and psychological selves are at risk, reflection occurs at a surface level, if at all. This is the reason why the controller in the above quotation appeared to be "as right as rain". In High-3 work environments, where reliable performance is crucial and where all mistakes need to be used as resources to improve the system, this lack of reflection needs to be challenged and confronted. Fortunately, from the data collected it would seem that there are not many controllers who engage in impression management and the social experience of work enables others to monitor such reflective avoidance if it is occurring at the console. Making the investigation of mistakes a socially reflective practice (to be discussed below) is another way to monitor and counter reflective avoidance.

8.3 Socially reflexive processes at work

Socially reflexive processes are embedded in both structures and cultures. Socially reflexive processes occur when individuals and groups engage in reflective activity in concert with others. In this section two aspects of socially reflexive activity will be discussed: the spatio-structural organisation of reflection and socially reflexive cultural practices.

8.3.1 The spatio-structural organisation of reflection

The structural organisation of work establishes two important means of socially reflexive practice. The first involves the spatial organisation of the work-space that establishes opportunities for *peripheral reflection*. The second involves divisions of labour that differentiate and integrate job roles and work tasks and establish opportunities for *proximal reflection*. These two forms of reflection, and the structures that support them, will be discussed below.

8.3.1.1 Watching others — watching you: Peripheral reflection in ATC work

The physical structure of the work-space such that work is public provides a valuable means of reflection in two ways: it allows controllers to watch others and in so doing, controllers also know that others can watch them. Peripheral reflection is possible because the technology used in ATC work enables those working at the console to notice how someone else is working. Thus one can watch, notice and label the patterns of work activity from a distance, from the margins, without having to directly inquire, as the following controller explains.

I: What is your sense of how people either share that they have made a mistake, or ask a question of someone who is more experienced? Or say that they were uncomfortable in a certain situation?

R: / There are very few people that will do that [ask]. A lot of them will sort of stand back and watch and file it away without discussing it. It is something you can do with radar technique. A guy can watch and see what is happening without actually having to speak with the guy and ask him how to solve the problem (Int. 95, Controller, Approach, Perth).

The visibility of the work to all those in The Room enables individuals to observe the work of others and thus to benefit through observation how someone else might handle a particular problem or the difficulties someone else gets into. In the next quotation, the controller believes his performance is lifted because of his self-monitoring as well as the monitoring of others.

I: How did you build up that knowledge?

R: I guess, because, you make a mistake, not a serious one, but you let yourself down a bit and / I guess you're self-assessing all the time and you wonder '*why am I doing that?*' pretty consistently, and you're doing that because you know people are watching you and you want to perform as well as you can (Int. 61, Controller, Enroute, Melbourne).

The visibility of the work enhances this controller's motivation to be constantly self-assessing. The visibility of the work also enables others to monitor the performance of others, should they be engaging too much in impression management. Knowledge of being observed by one's peers provides a motivation to monitor one's own work and to attempt to perform the work well. The public display of work also supports the constructivist view of learning, that what is regarded as

“good” work practice is not determined by some absolute external criteria but by the norms and expectations of a particular group (Putman & Borko 1997). These are the work practices that will be observed and emulated by others. What is regarded as “good” performance is determined by the collective values and beliefs (culture) of the group and will be discussed further in the next Chapter.

Of course, the knowledge that one’s work is publicly available is also an issue of interest to critical organisational theory (see Chapter Two) because of its capacity to be used for monitoring and surveillance. At issue in this Thesis is not the need to make work activity private but rather to ensure that structures of surveillance (if used) are themselves visible and the ways in which such data is used is transparent and open to question. The question here that needs to be addressed by organisational designers and workplace learning facilitators is: “What forms of reflection and observations are possible and how is this information used?” Educative work environments need rich sources of information to be available to individuals and to be shared within groups. However policies and procedures need to be in place to ensure data are used to enhance learning for educative purposes and not for punishment and control. This issue will be further discussed later in the Chapter.

8.3.1.2 Organising reflection into ATC work: Proximal reflection

In the same way that technology enables work to be publicly shared, so too do other structures of work organisation enable reflection to be organised into ATC work practice. As was outlined in Chapter Five, the Enterprise Bargaining Agreement introduced a change that had two important aspects: that controllers were required to become multi-skilled by obtaining a current rating on three sectors and by institutionalising the role of instructor within each controller’s tasks of responsibility. The change in roles enhances opportunities for reflection, by requiring that controllers move out of doing the job themselves, to either learning it again as a trainee or by becoming an instructor of others.

This change in role requires the controller to stop working automatically and to re-attend consciously to the task at hand. When the controller becomes a trainee again, he or she needs to “shift gears” from acting automatically to acting with a deliberate conscious intention toward learning. Systematically moving from one sector to another and becoming a trainee again is also important for the maintenance of certain generic controller skills.

There was one person that we had, their skills had actually gone backwards when we moved them onto the next sector because they’d been there [on the old sector] for too long. Their thought processes and all [the skills] they had, had just gone into, how can I put it, auto-pilot, and they were just doing it by auto-pilot. But when they were moved onto the new sector, they had to learn again and it was like starting from scratch again

because their ability to learn new skills was much lower than it would be if they were still in that learning process (Int. 113, Team Leader, Enroute, Melbourne).

This excerpt shows what happens to a controller who has remained on a sector for too long. Some of the skills needed for handling complexity, such as flexibility, and for coping with change had deteriorated. In order to perform well, controllers need to be able to learn new requirements, to modify and adapt their practice and to be able to constantly update their skills. The ability to “learn how to learn” also becomes an indicator of the controller’s flexibility and capacity for rapid skill acquisition.

Moving into the role of instructor is also important because it enhances reflection within work activity, something particularly important in High-3 work contexts. The process of instructing sets up opportunities for controllers-as-instructors to observe and reflect on the job of controlling — something that is difficult to do when engaged in temporally and cognitively demanding work. When a controller is instructing another, he or she sits or stands behind the person working at the console and watches the trainee controller undertaking the work. The picture illustrating the sociality of work in Chapter Seven (see Figure 16, page 149), showed, for example, controllers working and others watching. The controller standing behind the person working at the console and using the telephone could be an instructor. The practice of watching another do the work of controlling enables the controller to view the work activity from a different perspective. Controllers commented that having to become an instructor forced them to re-examine their own knowledge base. Stepping back from the job at the console had the advantage of giving the controller a different (wider) perspective.

I think it helps because you are going back to basics for yourself. You probably even in fact improve your own performance greatly on training because you start calculating things again and find a lot of things that you would perhaps put in your little ‘judgement block’ in the back of the mind, that you use all the time weren’t quite right. Maybe when you put them in they weren’t quite right. So with the trainee you are watching all the time and thinking “*What would I do here? What would I do here?*” so that you can come in if he is going to ask “*What do I do now?*”. You say “*Do this*” instead of having to think “*Oh God what do you do now?*” - having it all worked out in your mind (Int. 93, Instructor, Arrivals, Perth).

Thus, the process of observing a job — particularly one that has the characteristics of complexity — this requirement to take on the role of instructing, enhances the controller’s own opportunities of learning. Some instructors and some team leaders commented that the instructional role is sometimes used as a strategy to enhance the performance of the instructor.

I: What impact does having a trainee have on you and the way you do the job in terms of your currency?

R: In some ways it improves you because you become more aware of what is going on around you and you look at other ways of doing things and being forced to sit back and watch it in detail - you analyse it a lot more. There is an old saying on Approach '*he's been doing the job for a year now, it is time for a trainee so he can really look at the whole thing*'. Quite often training officers are selected from the point of view to improve the training officer not for the trainee's benefit. There is quite a bit of that goes on, and there's a lot of truth in it (Int. 65, Instructor, Approach, Brisbane).

In considering the transcript above, a possible first reaction to this would be to suggest that the main purpose of becoming an instructor should be to enhance the trainee's performance. However, it is argued from the perspective of the whole system of work activity, this would be an unduly limited view. Performance enhancement aspects of the instructional role of controllers should be acknowledged within structures of work organisation. Embedding the role of instruction within the job descriptions of all controllers has had, in this organisation, considerable benefits. Data collected from the interviews conducted in all Centres and all sectors revealed that undertaking the role of instructor is a structured task which improves the controller's own performance because it forces the controller to think about, justify and articulate the bases for the decisions he or she would be making if the instructor was doing the work.

8.3.2 Socially reflexive cultural practices

Organisational cultures also enhance reflection in important ways. The culture of a group is evident in the language (and the stories and myths) used by group members and reveals the values and beliefs that link them to the groups they belong to, or to which they desire to belong. Collective beliefs, values and norms shape the interpretations of experience thereby making particular aspects of those experiences available to group members.

Although reflection was described by Kolb (1984) as an individual process, by drawing on sociocultural perspectives (see Chapter Two), it is contended that the act of reflecting (through noticing and attending, pattern seeking and labelling), involves interaction with others and with the environment. The process of reflection involves observation and dialogue with others in order to know what to become sensitised to and what meaning can be made from an experience. For example, for collective learning to occur, the act of noticing requires an individual to be able to enter the experience of the other. Salient moments that have resonance for others turn into stories — true and imagined — that project the experience into something that others can share.

8.3.2.1 Collective Memory and the telling of "war stories"

The cultural practice of sharing war stories was introduced in Chapter Five. War stories are a means of collective reflection because they draw attention to certain features in the experience of the work. Through sharing war stories, the controller uses the vicarious experiences of others to reflect on her own practice and to envisage alternative choices of action, as the following controller explains:

I: Do people learn from other's mistakes?

R: Yes, I think so. Like you say, war stories and things like that. Every one will tell you '*One day I had two here and they did this and that*'. That's a great way of gaining ... If you can't see it yourself, if you can hear someone else's war story and when that happened you get something at that sort of place you think '*I remember hearing that. I'm not going to stuff up like that*' (Int. 44, Controller, Enroute, Melbourne).

War stories act as a form of collective memory and become resources used to guide action. The features of a war story are labelled by the narrator in a particular way that draws attention to values that are important in ATC work performance making the transfer of those values possible through this form of organisational memory. In the next part of this Chapter four war stories (see Appendix 11) will be discussed to analyse what they reveal about what is collectively noticed and remembered in ATC work. The stories are titled "The breakdown of the labouring body"; "One too many airborne"; "Six in the circuit and the jets are coming in"; and "The trainee who 'decked' his training officer". The stories are presented in Appendix 11 verbatim to give the reader a sense of the narrative and they will be discussed here in terms of what they reveal about socially reflexive cultural processes. The stories found in the Appendix were selected because they were heard in every Centre and thus represent a mechanism of collective memory and information transmittal between groups (e.g., "Six in the circuit and the jets are coming in" and "The trainee who 'decked' his training officer"). They also contain lessons about important attributes of experience discussed in the last Chapter that highlights a particular aspect of the experience of ATC work (e.g., "The breakdown of the labouring body" and "One too many airborne").

It is contended that the cultural practice of sharing war stories draws attention to certain important aspects of work performance. The first two stories draw attention to what happens if the temporal experience of work is ignored or overlooked in some way. For example, the story of "The breakdown of the labouring body" reminds controllers of the need to pace their bodies, lest they deplete them and burn out. Note the age of this story — about 40 years — the message in the story is still salient because managing the impact of the temporal demands upon the body is still an important feature of the work. The story "One too many airborne" reminds controllers of the consequences of temporally demanding work when a controller takes on more than can be handled. This is the same message in "Six in the circuit and the jets are coming in" and this story will be examined at length below. The story about "The trainee who decked his training

officer" has messages that were heard in all Centres. This particular war story was often referred to by both instructors and trainees when describing the tense relationship that can often develop between them. Underlying this story is the issue of power and its use and abuse in the instructor-trainee relationship. It highlights the belief that the role of the instructor is often to harangue the trainee to determine if he or she has the capacity to do the job under conditions of duress (a point further discussed in the next Chapter since the instructor's conceptual schemas, mediated by cultures, influence their instructional behaviour).

The war story "Six in the circuit and the jets are coming in" (see Appendix 11), for example, is a story about how an instructor allowed a trainee to get into a difficult situation. The temporal demands of the workload had become too much for the trainee, and in combination with the work's complexity resulted in the trainee losing *"the picture"*. When the instructor had to take over from the trainee, he too got caught up in the details of the situation and *"lost the picture"* himself and failed to have an accurate awareness of the impending situation. The story also provides an example of the social nature of the work and the relationships between sectors such as the Tower and Approach. The Approach controller alerted the instructor to the impending situation using the hotline, and the instructor, who had not been given an accurate briefing from his teammates, did not pay sufficient attention to the warning. Having realised the urgency of the situation shortly after, the instructor began to act and the Approach/Departures controller then took on a role of cajoling the instructor who was already under pressure *"are you going to be ready for this next one? - Departure - do you want it? Do ya?"* The person with the knowledge was absent from the work-space and the person responsible for conveying the information (to do the coordination) had *"an overly relaxed attitude"*. The story provides a good example of the consequences of a lack of interdependent sentience. Interdependent sentience, as discussed in the last Chapter, is the term used in this Thesis to describe the awareness required of controllers operating under temporally and complexly demanding conditions when carrying out work interdependently. Sentience is needed as controllers use all of their senses to gain awareness within interdependent work, as they develop and maintain awareness not just of their own performance, but of the performance of others.

The narration of this "warrie" draws attention to key features of work activity on a number of levels. First, it draws attention to how an instructor can be *"caught out"* and the consequences of an instructor extending beyond his limits, as well as for the trainee *"he saw me as being an Ace at the job and / it sort of came back to him"*. The interdependent nature of the work is also highlighted within the team as other controllers were reminded of their responsibilities to one another. *"He never did the crosswords anymore, / he realised that that job was a lot more important than he thought it was"*. When told in other Centres, the story marks the importance of within-team performance and of the dangers of assuming that a light traffic load does not require the same level of vigilance as any other day of the week *"from then on, people were careful on Sunday mornings just like every other time"*.

It is contended that socially reflexive cultural practices such as the narrating of war stories are a form of vicarious learning (Woolfolk 1994), because the stories shared contain valued elements of work practice that are collectively remembered and transferred. War stories form part of collective noticing and remembering about what can happen. They play a particularly important role in High-3 work environments where typical strategies of experimentation such as trial and error are not available (Weick 1987). War stories enable other controller's experiences to be shared and form a means of collective reflection because they remind organisational members to notice certain aspects of the work and the consequences when particular actions are not attended to. The marking, labelling and recalling of collectively held values of work performance, and what can go wrong, are then transferred across groups operating in the ATC system. Through war stories other controllers vicariously experience non-routine trouble and reflect on what needs to occur to avoid that situation. Sometimes war stories become the basis of simulator training sessions, as was the case in the "One too many airborne" story — so the trainee can learn the importance of recognising when one's limitations have been reached and saying "no".

8.3.2.2 Learning through war stories

As demonstrated in the above examples, people collectively reflect on many things when they engage in the telling of war stories because these stories form part of organisational memory. One's level of performance, developed through a variety of experiences, enables those with the most experience to tell the best war stories (and to participate in this kind of knowledge generation and transmission).

Stories are important because they register, summarise, and allow reconstruction of scenarios that are too complex for logical, linear summaries to preserve (such as a set of regulations) (Weick 1987). According to Weick (1987), a system that values stories, storytellers and story telling is more reliable than a system that derogates these forms of learning, "because people know more about their system, know more of the potential errors that might occur, and they are more confident that they can handle those errors that do occur because they know that other people have already handled similar errors" (p. 113). Telling stories, therefore, assists individuals to make sense of the non-routine. Through stories, group members accommodate the unfamiliar to their existing experience.

What happens, however, when the wrong messages are conveyed through cultural forms of collective memory such as the narration of war stories? War stories are a valuable means of enhancing reflection if they increase, to use Westrum's (1993) term, "requisite variety". At issue here is the need to develop strategies to enhance diversity of stories and to encourage critical reflection to analyse the messages inherent within them so that the values contained can be evaluated to determine whether or not such values are appropriate to continuous learning practice. Just as stories can be used as an aid to learning, however, they can also inhibit learning, since they can reinforce dominant stereotypes and norms of behaviour and thus non-learning

(Hendry, 1996). Encouraging critical reflection on the values underpinning war stories would be one means of encouraging changes in practice when those cultures support norms that would inhibit learning behaviours.

8.4 Conclusion

This Chapter has outlined the ways in which the process of reflection is enabled and constrained within structures and cultures governing work activity. From an analysis of the data, it can be concluded that the ways in which structural features such as the physical organisation of the work and its influence on experience (such as its intensity, immediacy and complexity) inhibit reflection and that this occurs in both accredited and informal learning. Other structures, such as those associated with policies of multi-tasking enhance reflection because the job roles are predicated on controllers returning to the process of consciously attending to the elements of controlling work. These work structures enable the controller to step outside the work of controlling and to observe another doing the work. In this case, being involved in the task of accredited learning leads to informal learning for the instructor. This particular finding also illustrates the linkage between aspects of accredited and informal learning. An important conclusion for future work organisation is that job roles should be evaluated in terms of what they enable or constrain reflection on experience within the job. Similarly, the design of work environments, for example, the degree to which work is publicly available to others, and the physical spaces available for people to meet and talk are important in enhancing opportunities for reflection within a work setting.

In environments characterised by High-3 work, the telling of war stories provides a cultural means of informal learning as people share experiences thus enabling others to reflect on those experiences individually and collectively. Telling stories assists individuals to make sense of the non-routine. Through stories, group members accommodate the unfamiliar within their existing experience. Thus stories provide a means of collective remembering and they enable experiences of an organisational system to be shared vicariously. Interpreting these reflections by identifying patterns and generating others for use in the future and for reframing or re-evaluating experiences is the process of conceptualisation and will be addressed in the next Chapter.

Chapter 9

Conceptualisation and ATC work

This Chapter examines the ways in which individual and collective conceptualisations in the form of schemas mediate workplace learning. It shows how the process of conceptualisation, which involves making sense of reflection through interpretation, generates into concepts or ideas that can then be applied to situations beyond the immediate experience. As such conceptualisation both enables and constrains sense making and interpretation of experience. This process occurs both individually and collectively. The Chapter shows how workplace cultures, in the form of collective beliefs, values and norms, mediate the conceptualisation process and in turn shape interpretation of experience.

9.1 Introduction

The process of conceptualisation involves making sense of reflections through the process of interpretation. The new understandings that are generated through reflection can then be applied or generalised to other settings. As discussed in Chapter Six a “schema” is a mental conceptualisation or structure which contains general expectations and knowledge about the social world (Augoustinos & Walker 1995). For Resnick (1993), interpretation of experience is based on schemas that both enable and constrain individuals’ processes of sense-making. Schemas can be both individual and collective and help guide what is attended to, what is perceived, and what is remembered and inferred, thus illustrating the close relationship between the processes of reflection and conceptualisation. Individual and collective schemas are linked through collective histories, through the ongoing interpretation of experiences, and are thus linked to routines and through collective routines to communities of practice (Hendry 1996).

This Chapter:

- reviews the conceptualisations and schemas collectively held in ATC; and
- analyses the ways in which they mediate practices associated with learning, either as part of work practice (informal learning) or as part of a formal accredited on-the-job training program.

In terms of cognitive learning theory, schemas provide a means of organising experiences and are influenced by socialisation (Augoustinos & Walker 1995). Schemas provide a context of making sense of what is noticed and observed. This is because a schema guides identification of what is noticed by providing a context for its meaning. Drawing on sociocultural perspectives (see Chapter Two) schemas also are inherently linked to the social and thus theorists of social cognition add a modification to the way schema theory has historically been considered within individualist psychological learning approaches. For theorists of social cognition, “information processing is, therefore, conceptualised as theory-driven rather than data-driven; that is, it relies on people’s prior expectations, preconceptions and knowledge about the social world in order to make sense of new situations and encounters” (Augoustinos & Walker 1995, p. 43).

Augoustinos and Walker (1995, pp. 36-42) identify four different types of schemas individuals hold relating to: persons, self, roles and events. They are

- person schemas which are used to make inferences from the experiences of interactions with other people based on conceptualisations about personality traits;
- self schemas, which involve the conceptual structures people have of themselves and which guide their own actions;
- role schemas which comprise the knowledge structures people have of the norms and expected behaviours of specific roles in society; and finally
- event schemas, which are used to anticipate the future, set goals and make plans.

Later in this Chapter these schemas will be used to demonstrate how two different workplace cultures have arisen based on differing self, person and role schemas. It will be contended that these collective schemas have led to differing conceptualisations of job roles and learning which have in turn led to different norms of work practice. The consequences for both accredited and informal learning in the workplace will then be discussed.

9.1.1 Schemas and conceptualisations about the social world

People use schemas when they make sense of the social world. Schemas work by mediating what people notice, what they look for and how they account for their and others' actions. In the following quotation a trainee describes her conceptualisation of what happens to trainees when an instructor's schema holds that the trainee does not have the ability to do the job.

I: Can you give me an example of how somebody's life would be different from having done [the training]?

R: Some of them were off work for two or three months, just unable to cope.

I: With training?

R: Yes. And being pushed.

I: Pushed over the edge?

R: Being pushed over the edge, yes. These are people that are, for all intents and purposes, competent. It seems previously, this is only hearsay, that basically turned up the first week they decided whether you are going to make it or not. If you were going to make it they would probably have made it a bit easier for you. If they decided you weren't going to make it, then they set out to prove that you weren't going to make it (Int. 69, Trainee, Approach, Location withheld).

The above represents a person schema. According to the trainee, an instructor perceives that a trainee does not have the traits necessary to do the job (ability) and thus sets out to prove that the trainee capable. Good controllers do have special abilities such as being good at mental calculations. The collective valuing of the importance of ability as an innate sense can detract, however, from attending to learning the job and instead emphasises developing strategies for detecting the presence or absence of these seemingly innate qualities. Although all controllers interviewed believed that ATC is based on ability, not all believed that it was solely this ingredient that made good air traffic controllers. However, all who were asked could identify other controllers who did believe this and who, as instructors, made it their task to weed out those without The Right Stuff (as discussed in Chapter Five).

In learning theory terms, collective support for a belief in ability is documented in the literature about the role of internal dispositions in expertise (Chi et al. 1988). However, research on expertise is equivocal about the degree of importance that should be given to special attributes involved and points instead to the role of motivation and length of practice (Posner 1988). Woolfolk (1994) summarises research into beliefs about ability and observes that two views

about ability are commonly found: that there are those who hold an “entity” view and others who hold an “incremental” view. An entity view assumes that ability is an internal stable, uncontrollable trait of the personality, a characteristic that cannot be changed. An incremental view on the other hand, suggests that ability, whilst internal to the individual, is also unstable and, therefore, controllable. That is, ability can be improved through effort (Dweck & Bempechat 1983, in Woolfolk 1994, p. 320). Controllers who hold an entity view of ability are likely to believe that it is something innate about that controller’s personality, and that one’s level of ability cannot be changed. Therefore, when operating as instructors, trainees or controllers are unlikely to look for ways to improve a situation and, as alluded to in the quote above, instead will emphasise, not learning and improvement, but strategies aimed at detecting the presence or absence of those abilities.

When people engage in a process of conceptualisation, they begin to categorise their perceptions and those categorisations are mediated by collectively held beliefs and values. Categorising people on the basis of limited information is known as stereotyping (Augoustinos & Walker 1995). Stereotyping can be both negative and positive. Both forms of stereotyping are a form of learning, though they are likely to constrain future learning if limited cues are then drawn upon to interpret situations and thus influence future behaviour. If stereotypes have been established and these stereotypes or schemas are reinforced through previous histories of experience, then individuals from particular groups may get a more difficult time in training from an instructor who holds a particular conceptualisation about the job and learning. For example, if an instructor holds entity view of ability and that particular groups of people, such as those from Flight Service officers do not have “what it takes” then these trainees are at risk of being given a much tougher time in their training, than would be the case if the trainee had an instructor who held an incremental conceptualisation of ability.

In sociocultural learning theory individually and/or collectively held beliefs and values mediate what an individual learns from an experience because they filter the interpretation of that experience and this is the basis for constructivism (see Chapter Two). If the collectively held beliefs and values discussed in Chapter Five are part of a controller’s schema, then value is placed on the means by which one demonstrate one’s ability through, for example, levels of performance and expressions of confidence. Beliefs and values mediate interpretation of work experience and these in turn shape the elements regarded as important in group membership. These become the desirable attributes to display to one’s peers and thus become part of an expression of self to the group. Ascribing to particular aspects of these beliefs and values becomes group defining and thus part of one’s social identity. Augoustinos and Walker (1995) make the important distinction between individual identity and social identity. “Social identity is that part of the individual’s self concept which derives from their knowledge of their membership of a social group (or groups) together with the value and emotional significance of that membership” (p. 98). Social identity is not just an aspect of individual or personal identity, since even asocial descriptions of self subtly depend on particular forms of social organisation

(Augoustinos & Walker 1995). In ATC, individuals belong to an occupational identity - one that values the skills controllers have and the way they use them.

As discussed in Chapter Five, collectively held beliefs about good controlling centre around the display of ability, performance and confidence. Membership in ATC depends to some degree on the demonstration of these attributes. Although being confident is absolutely necessary to be able to undertake High-3 work, confidence becomes problematic when individuals begin exuding confidence because they have invested in the collective beliefs listed in Chapter Five and they project these features as part of their identity — of being a controller who is always “in control” — as the following quotation illustrates:

I: Do you think there is also a group of people who feign confidence? Who don't actually have it together but,...

R: Oh definitely, and I would probably say that's the overconfident people.

I: So in fact overconfidence is in fact bluster?

R: Yeah. Yeah. And you can tell those people straight away like if something goes wrong, or if they have an incident or something, within a couple of days, they're back on their feet, you know what I'm saying?

I: Right 'didn't affect me'.

R: Yeah. And the reason that comes about is because of the culture, the older culture as well. You have to be seen to be '*in control, I can do anything*'.

I: And so therefore, this is my image that I project?

R: Yeah, that's the image (Int. 102, Controller, Enroute, Melbourne).

Creating an impression that one has these attributes, of a controller capable, confident and “in control”, illustrates their emotional significance and their value in demonstrating one's membership in The Room. In the quote above, people feign confidence because of a desire to be part of a group that has these qualities and to be perceived as competent and capable. However, when conveying confidence is used as a resource in impression management, the controller, in fulfilling his or her role schema, is unlikely to display behaviours associated with informal learning practice, such as asking questions, seeking information, or asking for assistance. This is because these behaviours do not fit the image the controller is attempting to portray and, therefore, this conceptualisation about one's work and role has a deleterious effect not just on the individual controller's capacity to engage in informal learning through inquiry, but on the entire system. Genuinely confident controllers were found to be more open to discussing problems or admitting their mistakes and do not feel vulnerable when doing so.

It's a lot easier to admit to a mistake if you're arrogant.... If I'm fairly confident about myself, I'm quite happy to say '*oh I always fuck things up*', (knowing that I don't). Whereas, if I'm very under-confident, I'm not going to admit to many mistakes. If you're very confident in yourself as a controller, it's very easy to admit that you've made a mistake,

you say 'Yeah, I fucked that up, I made a mistake'.— 'Because I know I really know how to do this, But I know also that I make mistakes and I can't stop making them and that's not a problem' — . 'It's not going to destroy me, knowing that I make mistakes' / [but] there are so many people out there [now] that are so vulnerable, they don't dare admit they make mistakes. The thing is, all of us are a bit vulnerable when we say 'I think you might be having a problem here' in other words, we're buying into someone else's business. Now, you notice that we all quite happily do it, generally. Controllers will stick their nose into other controller's business. The system survives because people are willing to do that. You have to have that. [But] Those that are not all that experienced or confident won't do that, so therefore, they become a burden. They no longer help the system. And not only that, but if they become unsure, and won't own up to it readily and won't admit that mistake (Int. 64, Instructor, Training Annexe, Location withheld).

The two quotes above (feigning confidence and being open to admitting one's mistakes) illustrate some of the paradoxical effects of self and role schemas involving confidence and its impression management. On the one hand, the controller who appears overconfident is likely to be perceived as under-confident and to be attempting to use this impression to cover up uncertainty because exuding confidence is part of a social identity. On the other hand, a genuinely confident controller will be more likely to admit mistakes than an under-confident one. The quotes also reveal differences in opinion about different groups in the room. The Enroute controller, quoted above, believes that it is the "older" style of controllers (typically found on Approach) that are perceived to believe they must be in control, and therefore, are unlikely to admit a mistake; whereas, the Approach controllers being discussed by the Training Annexe Instructor believe that the Enroute controllers are unlikely to admit to making a mistake because they feel vulnerable. This begins to provide some insights into the issue of contested cultures in The Room and the mediating role conceptualisation (through interpretation, schemas and identity) plays in the process of informal learning in the workplace.

9.2 Groups, collective conceptualisation and contested cultures

As outlined in Chapter Five there are a number of work groups in ATC and, in part, these groups are established through organisational structures associated with divisions of labour involving the differentiation and integration of job tasks and functions. The way work is organised then, structures work-groups in certain ways and thus concentrates work experiences of those work groups in particular ways. Individuals are enculturated into the experiences of the particular work-group. In the ATC workplace different work groups were identified and these were summarised in Chapter Five. As highlighted in Chapter Five, controllers define themselves by the kind of work they do (operational/non-operational work), by the type of airspace worked (e.g., Approach, Enroute) and what history of involvement they have had with the occupation or industry before entering The Room. These identifiers assist individuals to develop self-schemas

in relation to their peers and to join in membership with others who hold similar beliefs and values.

9.2.1 Working Approach and Enroute: Contested cultures across “The Room”

If “context matters”, then it will be likely that different work cultures evident in different work groups will have different influences in the ways in which members of those groups conceptualise their work practice. These differences will be evident in norms of work practice, and this in turn will have implications for workplace learning.

For the purposes of this Thesis, this section will focus only on the differences between two groups working in The Room, namely those working in the Enroute sectors and those working on Approach (see Chapter Five for a review of, for example, the ways in which the physical structure of the work-space separates these two work groups). In this section an example of contested cultures based on different experience of ATC work will be discussed together with the implications of differing conceptualisations about ATC work for processes of continuous inquiry. Before outlining these differences, it is important to add the following cautionary note. Just as the beliefs and values outlined in Chapter Five were labelled as exemplars and not necessarily comprehensive of all beliefs and values held by controllers about ATC work activity, so too, the following does not purport to represent the conceptualisations of all Approach controllers or all Enroute controllers or indeed all of the conceptualisations about work that a controller who supports the following might have. They are provided here as examples of the ways in which contexts can influence behaviour and thus learning in the workplace for some individuals and some groups.

The experiences of people working Approach and Enroute ATC vary in a number of ways. The most obvious is the difference in the number of years of experience between the two groups. As was outlined in Chapter Five, at the time of undertaking this Thesis, most Approach controllers have approximately 15-20 years of experience, having commenced on an Enroute sector and having worked their way around The Room, progressively, on to faster, and thus harder sectors until they reached “the top” position of Approach. Historically, this had also been recognised in pay scales and status (see Chapter Five). Over that 15-20 year period, many organisational changes have been instituted. These changes included flattening the organisational hierarchy, introducing measures aimed at standardising work practices particularly on Approach. Many Approach controllers also would have had the opportunity to work in a range of different locations including spending time at out-stations around the country. Conversely, controllers working the Enroute sectors are likely to have around 1-7 years of experience, are likely to have either always worked in a team or to have spent much of their ATC working life in one, and because of closure of out-stations and the centralisation of services, have not had the diversity of experiences of Approach controllers.

In contrast, the working life of many Approach controllers can be characterised as that of acting as "Lone Rangers". That is, working in an environment where they were individually responsible, without involvement in a team, and where the interdependence of work activity was less evident than it is now. The following quotation illustrates the independent work environment that many controllers of the Approach era would have experienced.

R: And if there is anything that identifies air traffic controllers, it is that independence. They can't recognise it as a group, but when you walk into the area centre you'd be very hard pressed to say if there was one common factor between these people. They are really an odd collection of people in the sense of one does not match his neighbour closely at all. And that is actually trained in fairly early. It's desirable I think to be trained in early. In the same way a certain amount of arrogance, I'd imagine [similar] to the police cadets. And I've seen it in friends of mine who have gone through the process. I think the same is true of ATC. And that is a necessary job function.

I: What do you mean by that?

R: I'd say, '*responsible for my own decisions*'. In other words, a trainee has only been graduated for a few weeks, so he's gone through this training process. He's only a couple of weeks on the line, he's sitting in front of the console doing his job. The Centre coordinator or SAAC as he was called then — this is an actual case — walks over to him and is concerned for this trainee because he knows he's only been around a couple of weeks and he knows the traffic's getting a little bit busy. So he wonders if in some way he can casually help this person get over this hurdle. And it's like a team leader, it was in the days where we didn't have team leaders, so he was just the room supervisor walking over. And he made a comment you know '*perhaps you can consider doing this*'. The trainee turned around and said to this person, with 30 years experience, '*if you can do it better, sit here and do it, otherwise leave me alone, I'm busy*'. And so the person left him alone. And it wasn't that he was trying to be macho or anything else like that. It's '*I'm responsible for these decisions and if you want to judge me on anything judge me on the decisions I have made or relieve me*'. And that is the basis on which it is done (Int. 18, Controller, Approach, Perth).

Controllers working in this context experienced work as something that was highly individualistic and this was the case before the implementation of teams in 1993. The following quotation illustrates the historic ambition of individuals to work their way around The Room. Being able to do the "hardest" job (Approach) was rewarded by pay scale before the flattening of the organisational hierarchy and the introduction of teams.

I: Tell me about the ego problem.

R: You have got to believe you are the best otherwise you can't do it. One of the differences about Approach is that, until you get there, you are always aiming at a harder job. You have always got something to aim for and you have got something to prove.

Once you get there, suddenly you have done it and where do you go? Everything falls flat. Then they start picking on each other (Int. 68, Controller, Approach, Brisbane).

The references to the desire to do a harder job and having something to prove, reflects the psychological investment these controllers have made in particular beliefs and values about the job illustrated earlier in this chapter and in Chapter Five. Social identity within this kind of work-group then, is based on one's performance within the group and its comparison with others and this influences the norms of Approach work groups, as the following Melbourne Approach controller describes.

We've had girls [Enroute controllers] come over and say '*You guys all hate each other! You yell and scream*'. We say '*it's part of the game! We've been doing it for years. It's a big game. It's one upmanship*' and / I guess it's just a release mechanism. Everyone does it. It's just the way it is (Int. 125, Controller, Approach, Melbourne).

This Approach controller is discussing the reactions of Enroute Controllers to the norms of behaviour on Melbourne Approach. In part, the norms of Approach are based on the individualistic climate outlined earlier. In contrast, these norms (and their influence of practices associated with informal learning) can be compared with the norms in Enroute teams, as described in the next quotation.

I: Is the learning from your mistakes shared at all?

R: Yes. I think so. / I guess it depends on the people's personalities. Some of the older guys probably wouldn't, — that have been around for a long time. That's not fair to say that all of them wouldn't, but there's some people that wouldn't. I think they'd keep things quiet and not say they've made a mistake because they wouldn't want to admit it. A lot of us are new out there and, I know when I first got rated, I'd quite often solve something and I would say '*Do you want to come over here for a tick? I've just had this happen. This is what I did and what would you have done?*' I'd just get stuff that way because how else do you learn? Luckily the people that I work with are all friends, so if they had something going on you could go and look over their shoulder and say '*What's happening here? What are you doing?*' I think you have to be careful who you do that to. If you know the person well enough, it is a great way of learning things (Int. 49, Controller, Enroute, Melbourne).

A team-based culture, demonstrating an openness to ask for assistance, to seek other's perspectives on work based problems, is more evident in this controller's work practice than in the norms of practice found in Enroute teams in general. It is contended that this, in part, is a compensatory mechanism given the inexperience of the Controller concerned and the uneven level of experience found across the two work groups. Yet the team environment also enables this controller to feel comfortable with practices of inquiry, compared to the newly rated

controller described earlier in the quote, where the controller responded to an offer of help with the phrase *"leave me alone, I'm busy"*.

Enroute controllers, also illustrate some different norms compared with the "yelling and screaming" that is considered normal on Approach. The following Enroute controller gives his impression of the norms on Approach and then describes some of the features of work practice within his particular team.

I: I'm really interested in how learning is influenced by the culture. For example, in some teams they look out for one another, and *'If I haven't seen this before I feel okay about asking about it'* and in other places, there's a culture of, well, *'I'd better not ask because I'm supposed to be rated'*. What's your impression?

R: /Just from the outside looking in, Approach on the other side, are very much the latter culture, that you described. *'You idiot!'* Typically, you hear that all the time, and that's sad too, because I think that the level of work or stress that we undergo during our normal work is enough in itself, let alone having that internal stress from the team itself. / Doing it the old way, not in the way the job's [now] done, but doing it the old way as in the mentality. Now I believe the culture in the past has been *'I can control everything. I am a supercontroller'*. You know? *'I don't care, keep sending me aircraft'* *'Oh what about that, you didn't do that?'* *'Oh stuff that, they don't want to know about that'*. It's sort of, people have fallen into this repetitive type of self-reinforcement that they think they're invincible. And that's been proven time and time again, people aren't. We all make errors, so the new culture, that I believe is a better culture, that I start seeing but you know, it gets overridden, by these one or two people, is one where *'Okay, it's ATC, [and] it's serious business'*. [compared with] in the terms of this older style team leader, *'Planes will hit, people will die'*, — very morbid type of attitude. The new culture is *'Okay guys, we've got a job to do here, let's get it done. I'll help you out, no problems, we'll get it done'*. If there's two people on, why should one person work extremely hard, whereas two people could share the workload and get it done? (Int. 121, Controller, Enroute, Melbourne).

This quotation suggests a different type of interpretation of the work environment *'Okay it's serious business'* - but let us work together to address the problem. This perspective is in contrast to a valuing of individualistic performance. The Enroute controller above describes the kind of conceptualisation found in communication-oriented teams. In such a climate, team-members are more likely to ask questions, share ideas, seek feedback about a particular problem.

As stated, the claim made here is not to suggest that all Approach controllers are individualistic and psychologically invested in certain role schemas which preclude, on the basis of the beliefs and values underpinning those role schemas, activities associated with informal learning. Nor is it contended that all Enroute controllers live and work in open communication-oriented teams. Indeed, as the Enroute controller above comments, there are Enroute Team leaders (and others)

who hold “older style” attitudes and behaviours. The important point to note from this discussion, however, is that beliefs and values, collectively held, permeate group norms and group cultures. The data discussed here suggest that beliefs and values, as part of the conceptualising process, filter what individuals and groups look for in events and shape interpretation and action in response to other events. In so doing these role schemas become part of the attributes that individuals seek to emulate in order to gain group membership. They are then in turn reproduced by those individuals in ongoing cultures. These beliefs, values and norms are used to account for and justify behaviours and these then influence the degree to which practices associated with informal learning are likely to be part of the norms of work activity. Conceptualisations influence informal learning, and they influence the role schemas and practices used by instructors involved in accredited on-the-job training.

9.3 Instructional strategies and conceptualisations about learning

According to a constructivist theory of learning, knowledge is a form of interpretation based on a learner’s existing conceptions (Resnick 1993). From this perspective, all interpretation of experience is filtered by what the individual currently understands and believes and so an individual’s belief systems are going to influence what that person accepts and learns. This theory holds true not just for learners but also for explaining the strategies instructors use to instruct and what they adopt from instructor training programs.

In this study, the three commonly held beliefs about what it takes to be a good controller that were identified and discussed in Chapter Five (ability, performance and confidence). These beliefs also were found to be important in determining how an instructor interprets trainee learning and performance and are linked to three broad pedagogical strategies undertaken by instructors. The three pedagogical strategies have been identified as “acting on”, “working with” and “working against”. Instructors would also use a mix of these strategies depending on their conceptualisations of the nature of ATC work and the trainee.

9.4 Beliefs about trainee learning and performance

Given the cognitive complexity of the work, it is not surprising that instructors hold some common conceptualisations about the importance of the trainee’s own ability as a key factor in determining the trainee’s success. The importance of ability in ATC learning is reinforced by structural features such as the stringent testing of candidates that occurs during the recruitment phase and is also mythologised into particular cultural artefacts, such as the Gun Controller who can do the work automatically and effortlessly. It is also important to acknowledge that ability must play a significant role in determining success. However, the issue becomes the degree to which the instructor believes ability is the only factor determining trainee success of one factor of many.

If an instructor attributes a trainee's successful performance solely to the notion of ability (and through the demonstration of performance), then there is little the instructor can do except provide a reasonably safe environment for the trainee to find their own way. Instructors who conceptualised learning in ATC in this way, talked about the training process as osmosis: learning occurred as a seamless by-product of the everyday work activity and the trainee "picked up" what was to be learned.

It is quite different I think to other organisations and institutions. Maybe airline pilots are a bit of a similarity where a co-pilot sits along side the captain and you would hardly call the captain an OJTI training person. He just flies an aeroplane up and down and lets the other guy have a go every now and again and when he has done enough landings and take-offs and what-not, they say '*Oh yes, we'll make you a captain now.*' That sort of, by osmosis, you take it all in and that is a bit of the way we do it too. / What you do is you sit in during work sessions and you throw them in the deep end. In the early days when it gets absolutely bedlam and dangerous, pull them out, and you get in and correct them all again and as time goes on you get less of kicking the trainee out and you jumping in to make everything run again (Int. 93, Instructor, Arrivals, Perth).

The instructional strategy described above, of "learning by osmosis" and "throwing them in the deep end" uses little direct instruction or feedback. For instructors sitting behind the trainee monitoring the trainee's interaction with people and technology, the role is perceived as an almost passive one. That is in order to assist the trainee to learn, the best the instructor can do is to do nothing. This means that the trainee is performing without the assistance of the instructor and has thus learned. In these cases, during the trainee's learning the instructor tries not to act or to intervene unless absolutely necessary, so that the trainee can learn from his or her own direct experience.

We are not in a classroom drawing things on boards. I'm just sitting there watching. There is not much more I can do apart from talking to you about it or anyone else like that. Or stopping you from taking my licence off me. There isn't really much more I can do apart from trying to give you some confidence. Stop sitting there behind you in a high chair writing notes. That's got to give you some sort of confidence. Just to let you go far enough but able to keep you out of getting into too much trouble. There's not much more can be done. / It is just sitting there letting them go and trying to see what is going on in their head and if they are starting to do things your way and they are saying the right words that you'd be saying at the same time, or about that time, then you can settle back and say "*Right, this person's ready*" (Int. 72, Instructor, Arrivals, Brisbane).

To these instructors, learning is a seamless part of the act of production, gained by allowing the trainee to have as much of a free rein as possible so that they build up their levels of experience

and of confidence and in so doing demonstrate their levels of ability through their performance. Successful performance in ATC is not possible with confidence alone; ability and learning through experience must also be present. However, without confidence successful performance is not possible. Instructors conceptualising ATC learning and performance in this way, therefore, believed a major part of their role to be building up the trainee's confidence. Strategies involved in building up confidence include providing opportunities for the trainee to learn through their own direct experience and building the trainee up to encourage confidence in their own capabilities.

I tend to let them have a pretty free rein on the sector — say what they want. I let them get away with quite a lot, so far as phraseologies go, but when it comes to separation, naturally there's a line drawn. You don't allow a breakdown to occur. But I'll allow most other things to occur and hope that's a lesson for them at least there, I hope that that develops their confidence, so that they haven't had me badgering them, reminding them of dozens of mistakes, I try not to tell them every time they've done something wrong, 'cause that tends to reduce their confidence. Let them have a run, and if no-body else mentions it, perhaps they'll feel a little bit more confident *'I handled that well today'*. *'He wasn't in my ear'*. The dangerous aspect is they may think that what they're doing is right, so you've still got to pick a couple of the main points, pick a few things each day, that you want improved and you just hope that they don't do everything wrong (Int. 53, Instructor, Enroute, Melbourne).

In this case, by not engaging in roles typically associated with instruction (see for example, Blunden 1997; Burns 1995; Heimlich & Norland 1994; Tovey 1997) such as asking questions, providing feedback, making notes to support later discussion, the instructor believes that he facilitates the trainee's confidence. The degree to which instructors conceptualised learning as building on the trainee's ability through exposure and the development of confidence leads to the employment of three broad instructional strategies, described here as: Acting On; Working With and Working Against.

9.4.1 Acting On

Instructors employing Acting On strategies typically conceptualise ATC work as based on an entity view of ability; a need to provide exposure to build up their own reservoirs of experience; and a need to imbue the trainee with confidence. Instructors engaging in a pedagogical strategy of "acting on" would have the trainee perform the work by either directly intervening and telling the student what to do, or by not intervening at all to give the trainee confidence. These strategies were colloquially called within ATC the "ventriloquist-dummy" and the "Mother Theresa" approach to instruction. The strategy of performing the work by telling the student what to do is akin to what Rogoff (1990) found in examining the instructional features of social interactions where the major goal of the activity was either on the teaching or on the accomplishment of the task. ATC instructors utilising an Acting On strategy, take the

accomplishment of the task as the major goal of the activity, and what the trainee learns, they will learn by themselves.

It's like some guy has his hand up your back, he says '*turn left 370.*' '*Turn left 370.*' '*Take up an easterly heading.*' '*Take up an easterly heading.*' And I'm somebody's mouthpiece and, you're fighting it to a certain extent. But you know it's the only way you're going to learn. It's the only way most of us learn anyway. It's the only way I'll ever learn I know that. And he's telling you what you do, and you don't like it (Int. 117, Controller, Enroute, Melbourne).

Acting On can also involve no intervention at all. The instructional strategy in this case occurs by allowing the trainee to do the job by themselves and for the instructor to display, largely through non-verbal communication, that they believe the trainee can do the work. The premise underlying this strategy is that the instructor has faith in the trainee's capacity to perform. In the following excerpt, the trainee previously had been working with an instructor who employed the direct intervention "ventriloquist-dummy" approach and was now working with another instructor, who employed the "Mother-Theresa" approach.

An aeroplane asks for something and they turn round and look at you and you go ... and [you] look away. All of a sudden you can tell that they have got a free hand and they are rapt. They get into it and they are working away and they are doing it all. They turn around and smile at you and you go '*Good, good. Has anybody seen the newspaper?*' Then you settle back [pretending to read the newspaper] and you are still watching. They are rapt and they are working and they are enjoying themselves and they are having a ball./ I ignore them / I don't take notes. I think it puts them off. '*If he's not writing notes I must be going OK.*' He will be watching out of the corner of his eye - '*he's writing something. Shit! What have I done?*' It does, it distracts them. So I just sit down there at the same height, usually resting on one elbow and looking a bit relaxed. When you tense up they can tell (Int. 78, Instructor, Arrivals, Brisbane).

In taking a "Mother Theresa" approach instructors Act On their trainees by attempting to imbue confidence to allow the trainee to learn themselves. In these cases the instructor conceptualises learning of ATC as a process involving the trainee building up experience and confidence so that they can expand on their given abilities. Such instructors will not use the adult learning and coaching strategies conveyed in the OJTI training program because such strategies are believed to negate the instructor's purpose (that is, to give confidence). The process of writing notes, for example, is believed to sap the trainee's confidence, since the instructor would only be noting what the trainee did wrong. Acting On strategies also include the degree to which the instructor uses artefacts in the training process, as the following instructor comments.

I: So it is interpreted as a slight?

R: Even to the extent that trainees will know whether you have plugged in [to] the monitor which means you can't come over the top of them [interrupt their radio transmission] or whether you have gone in live which means you can just talk if you want to. If you go in the monitor, that is a sign that *he has got confidence in me, I can do the job*. If you go in live, *he doesn't think I can do it*. It is all very much part of the confidence game (Int. 68, Instructor, Approach, Brisbane).

Acting On strategies can involve direct intervention (telling) or no intervention at all (having faith, believing in) and as indicated above, can involve subtleties such as where the instructor stands and how they monitor the trainee's actions. There are advantages and disadvantages to the employment of Acting On strategies. Direct intervention and telling the trainee what they should be doing can become a process of scaffolding as described by (Vygotsky 1978) where the trainee is able to perform work tasks beyond their own capabilities because they are helped by a more knowledgeable other. However, the advantages of scaffolding will only be achieved if the trainee is assisted to take over the work and to be able to do the work themselves. Similarly, believing in the trainee's capacity to perform the job by allowing them to operate the way they wish has the advantage of enabling the trainee to build up their own experiences. However, in attempting to imbue confidence such a strategy sometimes lead instructors to give the trainee an inaccurate impression of how they are performing and may lead the trainee to believe that certain practices are appropriate when they are not.

We have had a few trainees here where it has sort of been trying to be kinder in training and whatever and the person has got to the end of the thing and when they are still not aware of their short-comings they have been quite marked [inaudible] in there so you have got to sort of balance that when you are trying to cope with confidence - that you are not giving the person a false sense of security or false confidence (Int. 80, Instructor, Enroute, Perth).

Instructors who employ the Mother Theresa approach as part of an Acting On strategy are likely to appropriate from an on-the-job-instruction training program for instructors those strategies that support their conceptualisations of how trainees learn best and what the instructor's role is. In these cases, providing encouragement and positive feedback support an instructional purpose to "believe in" the trainee and so are used to this end. Acting On strategies are limited though because the trainee needs accurate feedback about their performance and ideas about how they can improve. Without these elements the trainee may fail assessment. Encouragement needs to be given to reflection on what seems to work and what is not assisting in progress.

9.4.2 Working With

Instructors who hold an incremental view of ability are likely to believe that their instructional interventions will make a difference to the way the trainee learns and will employ strategies to Work With the trainee in facilitating the trainee's learning. In these cases, instructors benefit

from involvement in instructional training programs such as those offered by ASA and they adopt the strategies they learn, as the following controller describes.

The "conscious competence" and "unconscious competence". I think that we really needed to know that. I thought that was really the first thing - what a good idea it was and then I realised that it is so much that when you are doing the job for years and you get a trainee, not only do you know what you are doing but you do it automatically (Int 99 Instructor, Arrivals, Perth).

These instructors will also hold beliefs about the importance of ability, experience and confidence, but perceive that these elements are not the only factors involved in the learning process. These instructors, therefore, use strategies associated with train-the-trainer programs because they are consistent with their role schema as instructors in facilitating learning in on-the-job training.

Taking notes [Respondent reading from the card provided describing instructional behaviours such as taking notes - see Appendix 2].

I have taken notes during the shift and I have found they have been really handy, especially for the debrief afterwards. Because it is really distracting to a trainee and I don't think beneficial at all to go into a long explanation about how something could have been done better when there is still other things to worry about. It is a very easy trap to fall into I think when you are a training officer because your mind is working at a certain speed, you can see where the situations will resolve, whereas the trainee is still thinking it through. So note-taking is of real benefit. I do a post-shift briefing. The last trainee I had did one every shift and that basically just took the formal 'How do you think you went?' and then (from what I can remember) the trainee would identify everything I wanted to speak about anyway. We would just discuss how maybe this could have been done. [reading from card provided again - *Providing regular feedback of progress*]. I try to do that when they are doing stuff good. It is very easy too to just say 'Good. That's good' during a shift. Just say 'Good' because that doesn't require the trainee to be distracted from their actual job and it provides that reinforcement so that is all right. Whereas if you say 'Oh I wouldn't have done that', the trainee is looking for an explanation and that is where you are better off doing it after the shift. I think the spots for feedback are easier to give the positives during the shifts and the negatives afterwards (Int. 67, Instructor, Enroute, Brisbane).

For these instructors, the adult learning (Heimlich & Norland 1994) and coaching strategies (Burns 1995; Tovey 1997) conveyed in the OJTI training program (see Chapter Four) are employed to increase opportunities for learning to occur. Strategies include observing and assessing the trainee's progress as well as interaction or dialogue with the trainee in an effort to assist the trainee to improve. Strategies include questioning, making notes and providing verbal

and written feedback that identifies areas of improvement and gives reinforcement. Instructors adopting Working With strategies value being involved in training and derive satisfaction from undertaking an instructional role, as the following controller describes.

I just find it extremely satisfying - I love it. You get a trainee through and it is a real buzz. / I guess in a way, working [in The Room] day-to-day, the only time you ever see ... you never get any ... you can work all day but there is nothing at the end of the day. You work, and the only time you are ever noticed is if you stuff up. There is no "*Oh gæ you did well today, that was really good*", there is only "*Oh you did that wrong*". Not that you want recognition, but it is not as satisfying as [instructing] / You come in and out every day working and you go home and there is nothing. / [in instructing] you have had a part in their career, which is really nice. (Int. 49, Instructor, Enroute, Melbourne)

Since ASA began investing considerable financial and human resources into on-the-job-instructor training programs, the pool of instructors adopting Working With strategies appears (from the data analysed) to be growing. What the data discussed in this Thesis reveals, however, is that providing instructors with information and tools to use to facilitate adult learning only provides part of an organisational development strategy. What is required also is an understanding of the ways in which existing conceptualisations of learning and performing – individually and collectively held – enable and constrain acceptance of instructional strategies provided in instructional training programs.

9.4.3 Working Against

Part of the role of any instructor is to make assessments about the progress of a trainee and to evaluate whether or not that progress is satisfactory. On the one hand, an instructor has a responsibility to facilitate or enable trainee learning, and on the other hand, the instructor plays the role of gatekeeper, to ensure that trainees who are not competent do not achieve a licence to operate. The final assessment of job competence is made by the team leader, though the team leader and instructor do confer during the training period and sometimes this consultation involves other team members who are asked whether they would be happy working alongside the trainee. In the majority of cases, the team leader undertakes the check assessment. In some circumstances, however, the instructor has made an assessment that the trainee is not going to be a competent controller. As discussed in Chapter Five, when controllers hold an entity view of ability and conceptualise good ATC performance as based on this view, then the instructor's role schema is not to facilitate learning, but to develop strategies to detect the presence or absence of ability and to weed out trainees who do not have "The Right Stuff". In cases where the instructor has decided the trainee does not have The Right Stuff, the instructor will employ a Working Against strategy to show that the trainee cannot do the job and in so doing will set out to "break" the trainee, as the following controller describes:

I: Have you ever had to talk [a trainee] out of it?

R: Umm..... I've never had to say.... Indirectly you can apply pressure on them, where that pressure then becomes the thing that breaks them./ perhaps if it's getting to the stage that they're not progressing you might have to change tack or you might get to the stage where they have to be put under pressure to make a decision. You then say, *'we're going to combine these positions you've got to be able to run this. It's no easier than it is on a Wednesday morning on one sector, we're going to push you through that right now'*, and you say *'We're going to load you up with work'* and you load them up with 6 hours a day work, the busiest sectors you can, and you come up with the most complex problems and you are bantering [sic] them, you are asking them questions, *'What are you going to do'*, *'What are you going to do'* to the extent they are becoming so taxed that they say *'Is this what it's like all the time?'* Now, no it isn't because you've combined positions that perhaps might not normally be, but you say *'That's no worse than if you were rostered five equivalents of Wednesday mornings in a row in the same week. That's exactly what we're doing. We're making sure that you can do that every single day of the week because we can expect that here, so if it's going to happen on one shift, why wouldn't it happen on another shift? We're making sure you can handle that day in day out'* And they say *'No I can't'* and they might make that decision themselves. / The other alternative is that you deliberately distract them and prove to them...

I: To teach them their limitations?

R: And similarly, if you're having a trainee that's having problems, towards the end, you can do the same and you can set them up good and proper. / And it's not nice, being a training officer is not a nice job a lot of the time, because people have to face the cold hard facts about themselves. / You do have to, in some cases, try and break the person, and try and prove their weaknesses and say *'well, if I'm not here, is this going to happen again?'* And yeah, if you see the slightest inkling that that could happen, you have to go for it and prove to them that's a problem (Int. 94, Instructor, Enroute, location withheld, emphasis added).

The role of the instructor as gatekeeper employing a Working Against strategy is to locate and weed out any weak trainees who are perceived as not being able to control safely, and this is an important aspect of the job. However, the strategy of Working Against uses indirect communication strategies to reveal the trainee's weaknesses to themselves, rather than providing the trainee with direct feedback about their lack of performance. Working Against is used when the instructor believes that a key factor of performance is ability and that the trainee does not have the ability to be able to do the job. Whilst it is clearly important to err on the side of caution in assessing the competence of workers in High-3 work environments, the strategy of Working Against can serve also to reinforce dominant stereotypes of behaviour (Augoustinos & Walker 1995; Hendry 1996). This is a major concern if the stereotyped behaviour supporting a particular culture needs to change (see Chapter Five). As the quote above indicates, "the slightest inkling" may be a particular demeanour, or characteristic that does not fit with the dominant values of a particular sub-group culture and may have little to do with actual work practice at all.

A controller, who was an ex-Flight Service Officer provides the following account of what it is like to be on the receiving end of someone employing a Working Against strategy.

I: Training as testing?

R: Yeah and also *'I'm rated, you're not and I'm going to show you a thing or two my friend'*. And I mucked up in the end. I made a mistake. It was bad for me because it knocked my confidence around. There was no support. This guy was *'Aren't I clever, I tricked you'* sort of thing. And it took me a while to realise that I wouldn't have made that mistake if I had of been able to do things in my own sweet time. I mean it wasn't a dangerous mistake, because he knew that it was going to be okay. But he knew that I had not considered a particular thing and he didn't do anything about it. He pushed me and pushed me *'C'mon, C'mon! Can he have this level? Can he have this level?'* kind of attitude. And in the end I gave it away before fully looking at what I was doing and so, / it was very destructive and those sort of people should be ... I mean, I didn't, I should have been the one that was counselled [de-briefed] then, I mean I needed it! But he was the one who definitely needed counselling (Int. 48, Controller, Enroute, Melbourne).

For this trainee the strategy of Working Against caused the trainee to make a mistake that had negative consequences for the trainee's affective experience and caused the trainee to lose confidence. For instructors who perceive their major role to be that of gatekeeper, the adult learning and coaching strategies found in the on-the-job training instructor program are likely to be rejected, because they do not match the instructors own conceptualisations of how the job is learned or support the gatekeeper role.

A lot of this [OJTI] course is bullshit. It's all very nice to be caring and sharing, but in our job, it's not caring and sharing. Some people need to be hit around the head with a piece of 4 by 2 because it's the only thing they understand. You can talk to people until you're blue and black in the face. Until you start yelling at them or saying *"for Christ's sake, do something"*, people sit there and allow things to happen around them. You have to take control of it. As an instructor, you have to push, push, push, all the time and that's very difficult with trainees some time / It's a mongrel of a time being a trainee (Int. 119, Instructor, Approach, location withheld).

The quotation *"It's a mongrel of a time being a trainee"* indicates, in part, the difficulties trainees can expect when undertaking accredited learning. This is because their own sense of power and autonomy has been removed (and in the case of Acting On strategies that involve an instructor's *"hand up your back"* – see quote on page 182) and because they are unable to act competently and confidently. Expecting a difficult time as a trainee can also be accounted for in terms of the widespread use of reliance on solely Acting On and Working Against strategies. Use of strategies based on Working With are increasing, as a result of the resources that have been invested in implementing on-the-job-instructor-training programs. However, what the data presented here

also show is the importance of the ways in which belief systems mediate how much information is adopted from typical instructional training programs.

This Chapter has illustrated how current knowledge and beliefs systems of controllers serve as critical filters influencing and determining what controllers will accept and learn. Recent educational research (Bredo 1994; Putman & Borko 1997, Resnick et al. 1993) has focused on the role of beliefs and experience in enhancing or limiting opportunities for change. This research suggests that the knowledge and beliefs of instructors must also become targets of change if a change in instructional practice is to occur. The evidence in this Chapter suggests that programs aimed at facilitating skills development for instructors need to focus on the existing knowledge and beliefs of instructors and to provide opportunities for challenge and confrontation of those belief systems.

9.5 Conclusion

In this Thesis it is contended that collective beliefs and values inform conceptualisations that mediate informal and accredited learning. Collectively held belief systems provide evidence of how work activity is conceptualised what is regarded as important or not and what is regarded as learnable or not. Further, given that history is embedded in all activity, collective beliefs and values are often contested. This is because individuals are socialised into different groups, and having had different experiences, build up differing conceptualisations about what is important in the work activity. It has been argued that what is conceptualised about work activity is influenced by structures because these structures differentiate work groups from one another and so concentrate work experiences in particular ways. Possibilities of experimentation and action, as indicated by these findings, will be taken up in the next Chapter.

Chapter 10

Experimentation and ATC work activity

This chapter introduces the ways in which structures and cultures enable and constrain opportunities for experimentation within ATC work activity. It does so by discussing two processes of experimentation and demonstrating the ways in which cultures and structures influence these processes of experimentation. The two processes are incidental or intentional experimentation and personal or collective experimentation. The Chapter concludes by discussing intentional experimentation that is shared, claiming that it is this form of experimentation that must be enhanced if workplaces are to become sites of continuous learning as part of work practice.

10.1 Introduction

In this Chapter the ways in which structures and cultures enhance and inhibit opportunities for experimentation will be discussed. Experimentation was described as the activity associated with developing choices and new ways of acting. In terms of Kolb's (1984) model, the process of experimentation provides a link between conceptualisation and experience and, therefore, involves processes associated with thinking (such as envisioning, and developing new alternatives) as well as immersion in experience (such as experimenting through doing something in a new way). In this Chapter, it will be argued that experimentation can be considered on two axes: intention and the number of actors involved. Experimentation can be intentional (deliberate) or incidental (accidental) and it can occur personally for individuals or can be shared collectively. Although the rhetoric in organisational literature exhorts leaders to allow organisational members to experiment, and indeed, to celebrate mistakes (see for example, Watkins & Marsick 1994), such a strategy is clearly problematic in High-3 work environments because the mistakes can be of such magnitude as to result in loss of life. Typical forms of experimentation such as trial and error are not viable options in these kinds of workplaces. Moreover, it can be argued that in the dynamic and uncertain environments outlined in Chapter One, sole reliance on a method of experimentation such as trial and error would not be viable in any organisation that wishes to remain successful. Therefore, other strategies for increasing the ways in which experimentation occurs and is shared need to be identified.

The Chapter:

- introduces the ways in which experimentation is influenced by structures and cultures;
- outlines the ways in which experimentation occurs within the ATC workplace; and
- considers the implications of organisational change for historical forms of experimentation in ATC work.

It will be argued that the attributes of experimentation are influenced by a range of different structures and cultures, and some examples are presented in Table 17.

Table 17: The mediation of opportunities for experimentation by elements of structure and culture.

EXPERIMENTATION (EXAMPLES)	STRUCTURAL INFLUENCES	CULTURAL INFLUENCES
<ul style="list-style-type: none"> • Developing choices • Generating Alternatives (e.g., through inquiry) • Practice • Trial and error 	<ul style="list-style-type: none"> • Public nature of work org. • Team work • Strategies associated with centralisation • Job role integration • Lateral linkages (e.g., boundary spanning) 	<ul style="list-style-type: none"> • Narration (e.g., war stories) • History of experiences of groups • Collective schemas and social identities

Table 17 summarises the influences of structures and cultures on opportunities for learning. The first column outlines the kinds of activities that are involved in the process of experimentation (see Chapter Six for more detail). The next two columns summarise, from the data, the structural and cultural elements found to be salient in enabling or constraining experimentation. In Table 18 these elements have been organised in terms of the ways in which they enable different ways of experimentation: as something that occurs privately or is shared, and as something that occurs incidentally or intentionally. In this Chapter the process of experimentation will be considered in terms of its degree of intentionality and whether or not such experimentation is kept private or is

Table 18: Processes of experimentation and influences of structures and cultures

KIND OF EXPERIMENTATION	INCIDENTAL EXPERIMENTATION OCCURS THROUGH	INTENTIONAL EXPERIMENTATION OCCURS THROUGH
Private/Personal Individual	<ul style="list-style-type: none"> • Work activity • Job roles in integration • Visibility of the work • History 	<ul style="list-style-type: none"> • Work activity (public visibility of work and through job roles)
Public/Shared Collective	<ul style="list-style-type: none"> • Visibility of the work • Job roles • "Self", & "role" schemas • Narration 	<ul style="list-style-type: none"> • Lateral linkages (boundary spanning) • Designated team roles • War stories

publicly shared (see Table 18). The rest of the Chapter will expand on the framework presented

above by commencing with a discussion of the ways in which experimentation occurs incidentally (both individually and collectively) and will then discuss the ways in which intentional experimentation occurs for individuals and groups. All forms of experimentation are important in this Thesis, though it is contended that experimental practices that are intentional and shared provide the best means of enhancing practice in ways that embed experimentation within a continuous learning process.

10.1.1.1 Incidental and personal experimentation: Learning vicariously

Although the High-3 nature of ATC work leads to structures involving a high degree of formalisation, no amount of formalisation will account for every work situation. In these cases one common means by which new alternatives are generated is through personal incidental experimentation, or trial and error. Trial and error occurs as individuals engage in work practice and, in so doing, notice that certain strategies seem to work better than others, as the following controller explains.

I: You said before that you then had a learning curve after you got rated.

R: Yes. I think most people do, because you get "let go" and then of course you see situations. When you first get rated you don't do things always as well as you can but because you do it and you stuff up and it's your problem. You think '*God I could have done that so much better. I won't do that again*', and you learn from trial and error I guess. You learn really quickly because it's your mistakes.

I: You are reflecting quite actively.

R: Yes. Every time you do something you are thinking '*That didn't really work very well. I could have done it better. Next time I'll do it this way*.' You are constantly doing that all the time (Int. 44, Controller, Enroute, Melbourne).

This quote reveals the close association between experimentation and the other processes involved in Kolb's learning cycle. The newly rated journeyman controller ("let go" from the confines of the formal on-the-job training setting), experiences making mistakes and critically reflects on how and why these mistakes occurred to generate new alternatives for future action. In the interviews conducted for this study, newly rated controllers often mentioned the high degree of incidental (and personal) reliance on trial and error after receiving their initial rating because they were responsible for the airspace and, therefore, began to learn from their own mistakes.

I: Someone has said to me that you don't develop technique until you have got your rating because they are not your techniques - you are just using somebody else's.

R: / You do. When you are finally rated and you waddle off with a rating in your pocket [that] is when you really start the learning session. All that has happened up until that point is somebody has sat with you and beaten you across your head enough times to keep you out of trouble. Someone to say '*Yes, he is safe to leave on their own, They shouldn't*

hang together’. And from then on, when you sit on your own, as you do when you go solo flying, and then you really start to figure out what is going on. How to do this and that and you make a few prize blunders and so on (Int. 93, Instructor, Arrivals, Perth).

Incidental and personal experimentation, as the controller above explains, allows the controller to build up his or her own techniques and “style” of controlling — of working out what best works for them in solving the problems presented. When engaging in accredited learning, incidental experimentation through individual observation of practice does not just occur personally for the trainee. It occurs also for controllers and instructors watching others. As discussed in Chapter Seven, the publicly available nature of the work enables controllers to notice how someone else has solved a particular problem and this in turn expands the range of alternatives available to the controller concerned (see for example the section in Chapter Eight on peripheral reflection). Structural policies such as the Enterprise Bargaining Agreement enable both trainees and instructors to learn other ways of operating by undertaking the associated changes in work role. In the following transcript the interviewee is describing how the role of instructor expands her range of alternatives by watching the trainee solve a particular problem.

I: Can you tell me about that [the need to be patient with trainees]?

R / Sometimes I think ‘*I wouldn’t have done that*’ but it works out very well and I tell the trainee that. I say ‘*I wouldn’t have done it that way, but it worked out really well*’ (Int. 61, Controller, Arrivals, Brisbane).

For instructors like the one above, new alternatives are generated when they observe a trainee do something not within their own repertoire of experience. This form of incidental vicarious experimentation, through watching another take an alternative course of action, generates increased possibilities for action that can then be adopted by both parties. The degree to which these incidental forms of experimentation may or may not be publicly shared and collectively accessible, however, is an important issue particularly when attempting to develop continuous learning environments and this will be discussed next.

10.1.2 Sharing incidental experimentation:

Collectively shared experimentation occurs incidentally when, for example, controllers work in the same team and, in so doing, build up a range of alternatives of experience that can be drawn on by group members. This occurs either because team-members work alongside one another on the same shift and over time build-up a continuity of (present) experience that can be used as a resource in current activity, or because team-work enables controllers to draw on the (past) experiences of team members as resources in increasing the range of options available. People working together also develop a (sometimes tacit) understanding of the working preferences of other controllers, thereby enabling individuals to anticipate the needs or work practices of another.

10.1.2.1 The role of team-work in sharing incidental experimentation

It is contended that, just as other artefacts such as tools and notational systems (e.g., the paper strip – see Chapters Five and Seven) enhance reflection by making work publicly available, a work structure such as team-work also provides the opportunity for shared “referential anchoring” (see Resnick 1993 for a specific reference and Chapter Seven for a general discussion) and this has consequences for increasing the range of possible actions available. Team-work enhances opportunities to share awareness and noticing and thus to generate alternatives for future action, because as team members work the console together they begin to develop and share a common history. Furthermore, a shared body of experience enables controllers to feel more comfortable about seeking out the experiences of others in relation to particular problems, so that one inquiring into another’s experience might learn a better way of handling a presenting problem. The following controller describes the kind of inquiry-oriented norm of practice that has generated in some teams and the outcomes for shared experimentation.

I: Is that learning from your mistakes shared at all. Is there a camaraderie?

R: My team leader I’ve got now is actually the person who trained me. I’m really comfortable with him. He knows what I can do and I am more than happy to say to him ‘*Can you come over here for a tick? What’s your opinion of this?*’ If you don’t ask you sit there and think ‘*I know that wasn’t good, but I don’t know what else I could have done.*’ Sometimes you have got to ask, but I think some people feel a bit intimidated or think ‘*he’s going to put a black cross next to my name if I ask a stupid question.*’ Not many of them would do that I don’t think. I think you are more likely to get a tick for asking than a black cross for sitting back and saying ‘*What if it happens again? What am I going to do?*’ (Int. 49, Controller, Enroute, Melbourne).

As illustrated above, as a structuring device, team-work provides the anticipation of a shared referent point — when one member of a team has not experienced a particular past but can draw on the past experiences of others. A continuity of experience enables the shared past of one controller to be used in present conversation with another.

The development of a continuity of work experiences does not just enhance informal learning, as described above, but also assists trainees involved in accredited learning. From the perspective of the trainee, team-work means that he or she meets with the same people and almost without exception, those interviewed believed this enables a quicker learning curve as trainees become used to the work practices of those surrounding them, as the following controller explains:

I: How do you think teams have influenced on-the-job training? Do you think they have made it better, or have they had any impact at all, or none? Or was it worse?

R: I guess from someone coming in who hasn’t been in the culture before, it’s excellent because you are working with the same people every day. You get to know the people

you work with quite quickly. It's not like you come in every day and see more new faces, more new faces. From that side of it it's good because you get to know the people and they get to know you as well. If your training officer wants a break they are happy to sit in with you that's fine. Everyone sort of gets to know each other quite quickly. From that side of it, if you get on a good team it's good, if you get on a bad team, you're in trouble. (Int. 49, Instructor, Enroute, Melbourne).

As the controller above describes, teams have provided a reasonably stable environment for trainees to learn on the job, provided they are part of a "good" team. The team enables the new controller to become quickly socialised into the organisational culture of that team. However, at issue here is whether the norms of practice within the group support learning — informal or accredited — or as the controller above suggested *"If you get on a bad team, you're in trouble"*. Whilst many of the excerpts relating to teams used in this Thesis have been positive, by identifying the ways in which teams enhance the various processes involved in learning, there are many teams in ASA that do not support an open climate of inquiry — necessary for enhancing both informal and accredited learning in the workplace.

Norms of practice enable or constrain experimentation, and thus learning, and illustrate the influence of collective schemas (see Chapter Nine). From this perspective, working on a "good team" increases the "requisite variety" (Weick 1987) available to team members in the group because people are happy to share what they know. However, structures such as teams will only enhance requisite variety when other conditions are present. If a culture or norm of communicative practice of a work-group is one based on, for example, a collection of "Lone Rangers" (see Chapter Nine), then this inhibits communication and inquiry. Communication patterns evident within a team also will be mediated by the controllers' own individual conceptualisations about their roles (i.e., self and role schemas — see Chapter Nine) and whether or not group norms support this practice. The culture of communication between work-team members, be they acting as trainees, instructors or working as controllers, influences the degree to which opportunities to learn through incidental experimentation occurs and is shared. It also influences strategies used in both formal and informal learning that have as their basis intentional experimentation.

10.1.3 Intentional experimentation

Experimentation does not just occur incidentally or accidentally, it also occurs when, individually or collectively, we set out to deliberately increase options, to try something new and to benefit from those experimental strategies.

10.1.3.1 Intentional and individual experimentation: the role of culture

Conceptualisations of controllers as "Lone Rangers", as discussed in the previous section, also limits interpersonal inquiry within informal learning and thus the opportunities for the controller to generate alternative strategies through dialogue. In the following transcript, for example, the

controller inhibits the possibilities of increasing his own options for handling a problem, through refraining from asking a team member for help, because the norm of practice within his team does not support inquiry.

I: Under what conditions would you ask?

R: There have been times in the past when I've been training or I've had a question or something I couldn't quite understand and I think '*Would he know? I'll ask.*' But '*No, I'll pick it up.*' And sometimes you do and sometimes you don't, until later [and] you think, '*oh God! Is that what they meant?*' And it can be little things. It can be something you really should have asked about, / [now] I would ask more because I've been involved with training. If people don't know you don't know, then you [the instructor] won't tell them, but whether people who haven't been involved with training would ask? I don't know. Because I know I didn't. And there was some stuff I really should have asked about.. [But] '*I don't want to look stupid, I should know that*' / or it's been explained once, it's been explained twice, I still haven't got it. '*Oh well, I'll pick it up.*' I'd hoped! (Int. 90, Controller, Arrivals, location withheld).

For this controller the process of intentional inquiry is hindered because the controller does not wish to reveal his lack of knowledge to another. In this case generating alternative courses of action was constrained because of a belief the controller held that "*he should know*". If one has a role or self schema (see Chapter Nine), that as a competent, capable and confident controller, one should not have to ask others for information or assistance, then this inhibits the controller's use of inquiry and thus of informal learning. Furthermore, there is also a possibility that the controller's social identity (see Chapter Five) may be at risk by engaging in inquiry, because such actions may be at odds with the social identity constructed - on being a confident, capable, controller (see Chapter Five) leading potentially to impression management (see Chapter Nine). These role and self schemas also mediate the level of inquiry that may be used to generate new possibilities for action in the instructor-trainee relationship. The following controller describes how different she perceives herself to be to admit to a trainee that she does not know the answer to a question, and the consequences for trainees if an instructor "muddles through".

I: In terms of your own instructional capabilities, what have you noticed that you have improved?

R: / Improvements... I'm not sure. Over the years, to me if I don't know something, it is no loss of face to ask someone else. If I don't understand it properly ... / I am not afraid either when I am training to try. If I don't know something or I can't explain something [to] I have to ask someone else. I know a lot of other people just try and see it through so that the trainee misses out.

I: So the instructor is... are you just saying that there are things that you are not sure about so you would go and ask someone else as an instructor?

R: Yes.

I: Whereas another instructor wouldn't do that and so therefore ...

R: Yes. It is a bit like loss of face if you don't know the answer to this question. I find that when I am a training officer I probably learn a lot anyway. That is one of the things that's why I enjoy training because I learn as well (Int. 61, Controller, Arrivals, Brisbane).

For this controller, incidental vicarious experimentation is kept private for many people, presumably because the same role and self schemas of being competent and "in control" are operating. This instructor feels comfortable enough with her self and her role to not fear "*losing face*" by either admitting that there is something she does not know or in commenting that the trainee did something she had not previously thought about herself (see earlier quote). In the first instance the instructor engages in intentional experimentation by seeking to inquire and increase the options (or understanding) for both herself and the trainee. In the second instance, incidental vicarious experimentation becomes intentional experimentation when observations about the strategy are communicated and noted as a valuable strategy both could try again in the future. In this example, intentional experimentation is mediated by the degree of self-efficacy the controller feels, an indication of the controller's affective experience of work (see Chapter Seven).

10.1.3.2 Intentional and individual experimentation: the role of confidence

Confidence is related to a feeling that one can do the job and succeed with effort. Underlying this feeling is the notion of self-efficacy (Bandura 1997). A high sense of self-efficacy, as discussed in Chapter Two, leads the individual to feel confident about trying new things and being open to new ideas. In the interviews it was found that a lack of confidence lead to controllers and trainees not being open to new ideas, nor to communication about experimental approaches that might help them if they tried them out. Self-efficacy when manifested in the form of confidence, then, can limit the communicative relationship between the instructor and the trainee in accredited learning, which will in turn limit the trainee's capacity to benefit from the strategies intended by the instructor, because the trainee is not open to trying out new ideas, as the following controller explains:

I: Tell me, I guess, from an instructor's perspective, what is it that students have the most difficulty learning? How do you get them through that?

R: / I suppose to sum it up maybe, that the trainee is very worried about what is going on. They seem to get into a little shell and you can't communicate with them very well and the people around them can't communicate very well and that is a part of the job. I mentioned that I have found particularly with [name of trainee] for the first half or more of his training, that he was really in this sort of shell and anything you say, you didn't really think you were getting through to him then (Int. 85, Instructor, Approach, Perth).

For this instructor, his capacity to reach out to the trainee and to assist in generating alternatives is hindered by the trainee being concerned about what is going on, thus limiting the opportunities for the instructor to bring to the trainee's attention an increased number of options. The reason for this communication problem is likely to reside in what the next controller described as a lack of confidence leading to the instructor not easily being able to communicate with the trainee.

I: Just focusing in on the instructor-trainee relationship for now, could you give me an example of when things worked really well and an example of when things were really difficult with a trainee?

R: / An example of it not working very well, is when you can't make yourself, the importance of a particular point being understood. And the trainee in this case has got predetermined ideas - you can see that. Of how something should happen and it's generally that they've picked it up from other controllers, they've overheard it somewhere and they feel that this is the way it should run. In those cases it's quite difficult to get them to change. You've got another problem too, because it's not only that they've got a preconceived idea, because you could give them this other information and they could try it — but they're a little bit frightened — and they've got this idea. They've seen it work for someone else and they're going to keep pushing the barrow, and they're not relaxed enough or confident enough in themselves to try this new idea. So that's why I think it's important to develop somebody's confidence, as long as they're safe, so that they're willing to try different techniques (Int. 51, Controller, Enroute, Melbourne).

The quote also reveals the linkage between formal and informal learning and its relationship with experimentation and confidence. The instructor in the quotation above subscribes, in part, to the strategy of Acting On (see Chapter Nine), the aim of which is to build up the trainee's confidence, because he believes that doing so will enhance the trainee's affect and this in turn will lead to a greater openness on the part of the trainee to experiment and try different techniques — as alternatives suggested by the instructor. The quote also reveals how the trainee's conceptualisation of the job or "event" (see event schemas in Chapter Nine) of "*how it should not*" limits or inhibits the trainee's capacity for experimentation. To build confidence and to enhance trainee intentional experimentation, the instructor builds a "protective cocoon" (see Hughes et al. 1992) around the trainee to allow the trainee to experiment and to build up his confidence and openness to suggestions. This was also discussed by another controller as follows:

I: Did you detect that he was not confident?

R: Yes I did and my approach to that was to try and let him go as much as possible — try and let him experiment as long as things were safe. I didn't mind where he took the

aircraft around the sky. I wanted to let him build up his own confidence (Int. 84, Controller, Arrivals, Perth).

In this case the controller is likely to hold to a belief about the importance of exposure and performance (see Chapter Nine) and to allow the trainee to have as much of a free rein as possible with the intention that through the trainee's experience, their confidence and performance will increase. In this case, it is the instructor's intention to build up opportunities for experimentation, however, these may not be mutually shared. The intentional sharing of experimental strategies is not just limited by culture alone. Structures are also implicated.

10.1.3.3 Intentional collective experimentation and the organisation of work

Opportunities for experimentation are both enhanced and hindered by the ways in which work organisation emphasises the temporal dimension of experience. If members have not spent much time in the workplace, and thus have not had the opportunity to build up a range of options for handling problems based on their own experience, then this will hinder their capacity to allow others to develop alternatives and to experiment and also will limit the range of alternative strategies they can share. The consequence of this is that the trainee's options for his or her own experimentation are then further limited. In the following transcript the controller is discussing the length of time needed in the job (an Approach sector) before that controller would feel comfortable in taking on a trainee.

I: I was speaking with somebody on Approach and they said they felt like they still didn't have the experience after six years.

R: Yes. The things I would say if you went in there to talk to one of these recently rated guys, and said '*How about taking on a trainee?*' They would say '*You have got to be joking*' because it is a very demanding situation in the position and if you are a new boy on the block, whenever you have a problem you have one way of solving it and you might have two ways of solving it. An experienced guy would have two or three ways of solving it and have lots of other options to make it safe. So he can have a trainee. The trainee can run to the edge and make a complete mess of it and he will be able to go in and rescue the situation. The guy with two or three years experience hasn't got that. He knows he hasn't got that so if he had a trainee, he would have to take over earlier than the more experienced guy (Int. 96, Instructor, Approach, Perth).

In the quote above, the lack of depth of job content knowledge, based on limited work experience, in turn limits the kinds of experiences the trainee can have because an inexperienced controller/instructor does not have the same degree of options or resources available for handling the problems the trainee might encounter. The consequences, therefore, are that the trainee's capacity to try out various options is limited in two ways. Firstly, they are limited directly, because the inexperienced controller/instructor would need to take over sooner than

someone with more experience would and, therefore, the trainee will not have as much opportunity to try out their own problem solving alternatives. Secondly, they are indirectly limited because the instructor has fewer options to share with the trainee in terms of strategies for action. This is of concern to newer controllers acting in an instructional capacity because of what they perceive is a “dilution of experience” found within different sectors in The Room (as discussed in Chapter Five).

I think, people training after six months... I mean it's okay because we are pretty fresh out, we still know our theory but you can teach people all the theory in the world and you can tell them how to do the job, but if you haven't got that experience base to hand on to them, they are really missing out I think. Then they haven't got that experience base. So then when their six months is up, they train and they have got no experience / [and] the level of what people can teach gets narrower and narrower. Whereas if you have got someone who has got years of experience they can pass on that knowledge and then they can pass on ...I think the nice-to-know stuff is getting less and less because all we know is the facts and so that is all we can teach. We can't pass on our years of knowledge (Int. 49, Instructor, Enroute, Melbourne).

For some instructors, particularly those in the Enroute sectors, the “dilution” of experience is a concern because it limits the alternatives that can be passed on to the trainee since, as instructors, these controllers do not have the job content knowledge to draw on. Therefore, controllers need opportunities to develop working alternatives in a range of situations before they feel comfortable taking on a trainee because their own experience level and lack of options is likely to limit the experiences they can allow the trainee to have. The concern expressed by this Enroute controller also signal a consequence for the structural division of labour across The Room, where teams of new recruits are concentrated in the Enroute sectors and teams of experienced controllers are, for example, situated on the other side of The Room in Approach.

A structural change such as the introduction of teams then, has resulted in uneven access to the histories of experiences available. For example, a team on Approach, which consists of seven members with on average 15 years experience each, has hypothetically at least 105 years of experience on which to draw. Whereas, an Enroute team with the same number of members is likely to have between 7-30 years of collective experience. Given the importance of longevity of experience as a necessary precursor to effective work, teams where there has been less collective experience have tended to develop different cultures that include openness and inquiry (see Chapter Nine) as a means of compensating for the lack of individual levels of experience. In so doing teams with more communicative norms of practice enhance their “requisite variety” (Weick 1987) and; hence, their options for handling novel situations. This finding has been found also in work groups in other industries. Shaiken (1996) found that skill acquisition was collectively acquired in a newly automated manufacturing plant because the pressure of production left groups of novice workers with few alternatives but to work together to diagnose

problems and to plan solutions. Although Shaiken (1996) provides valuable insights into how groups can support each other and enhance the collective development of skill, more systematic strategies of enhancing “requisite variety” (Westrum 1993) need to be found and these will be discussed in Chapter Twelve.

10.1.3.4 The role of boundary spanning in enhancing intentional and shared experimentation

An example of one of the structures that influences the way in which intentional and shared experimentation operates within The Room involves the lateral linkages between two divisions: between the air traffic services division and the safety and quality assurance division (see Chapter Five, organisational structure). Currently, there is little linkage between the work of [what was called in 1996] the Safety Assurance branch and the everyday operations in The Room, yet both are implicated in work undertaken within ATC. That is, if a controller’s error leads to an incident (see Chapter Four), the controller is relieved from duty and an investigation commences which involves staff from a separate organisation, the Bureau of Air Safety Investigation, together with staff from the ASA’s own safety assurance branch. The staff arrive at the Centre from their offices in Canberra, interview the controller(s) concerned and return to Canberra where a report is prepared that in most cases leads to the sanctioning of the controller and may or may not lead to the institutionalisation of a new procedure. The problem with this approach is that a mistake remains as an individual’s responsibility and decision-making about the error is made remotely from the Centre, though the outcome may lead to a changed practice for either all controllers or for controllers working certain configurations of air space. It is contended that the potential for learning from mistakes is constrained by the punitive attitude taken and the lack of opportunity for evaluation and follow up. If the addressing of errors was the responsibility of the whole team (Hartel & Hartel, 1995), the whole team could look for ways to avoid such errors, by engaging in intentional and shared experimentation to problematise the practices that led to the error, and to find systemic solutions, some of which might include changes in work flow management or refinements to team coordination or communication strategies. Such a strategy has already been discussed in Owen (1996a, 1996b). This strategy enhances shared and intentional experimentation by structuring team-based work activity to include reflecting and discussing existing case studies of air traffic incidents so that those teams can evaluate their own practice and develop alternative practices if necessary. Changes would need to be in line with existing formalised procedure or recommendations made to change these.

10.1.4 Conclusion

This Chapter has discussed the ways in which cultures and structures enhance and inhibit opportunities for experimentation. Experimentation involves processes such as trying out new options and generating alternative courses of action through thinking, as well as identifying alternatives through reflecting on experience. Experimentation, therefore, can occur incidentally and intentionally, and it can occur individually or collectively. Work environments based on goals of enhancing continuous learning highlight the need to look for ways to increase the amount of

experimentation that is both intentional and shared. From an analysis of the data presented, it can be concluded that within ATC, structures such as teams enhance opportunities for experimentation because they enable the diversity of present and past experience to be made available. However, appropriate cultures that enhance communication need to be in place for learning to be enabled in this way. Both accredited and informal learning can be enabled and constrained by the kinds of communication processes embedded within particular workplace cultures. Moving these forms of incidental experimentation into the future requires strategies of intentional experimentation and implicated here are both structures and cultures. Although all forms of experimentation are important, it is argued that, changing organisational environments need strategies aimed at enhancing continuous learning. The implications of change, especially in technologically dominated environments, for informal and formal learning will be the focus of the next Chapter.

Chapter 11

Change and its impact on performance and learning

This Chapter discusses a number of key changes that have occurred in the ATC workplace. In doing so it addresses the third research question: “In what ways do organisational changes, such as the introduction of complex technologies, influence workplace learning?” The Chapter traces some of the changes that have occurred in the past, are changing in the present and are likely to occur in the future. It concludes by arguing that the trajectories of change highlight the need for new skills associated with “intellective interdependence”, based on the requirements of interdependent intellectual work.

11.1 Introduction

It is evident from the material already discussed in previous Chapters that there are many significant changes occurring within the ATC workplace. Some of the changes introduced into ATC work have been as a result of shifts in the socio-economic and political climate which have, for example, altered the relationships between ATC and stakeholders, and which have in turn changed policy and procedures governing work practice; others have occurred as a result of technological development. With these changes come changes in workforce identity (and resistance to change) as controllers struggle to make meaning from the work that they do and to situate their work within broader communities and practices. These kinds of changes are important to this Thesis because they all have implications for accredited and informal workplace learning and for the possibilities of creating continuous learning environments. This Chapter addresses the research question:

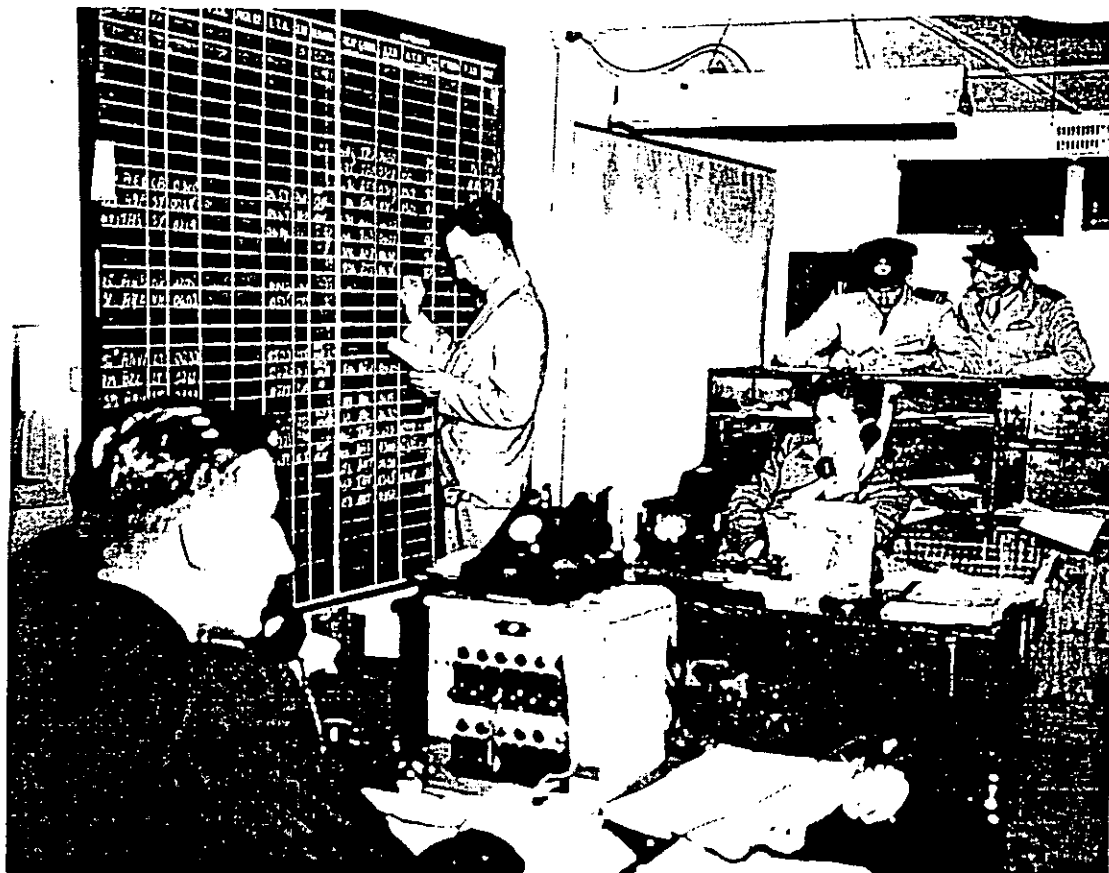
- In what ways do organisational changes, such as the introduction of technology, influence workplace learning?

This Chapter explores a number of changes and their implications for learning in the workplace for the future of work. The Chapter:

- reviews the salient changes that have occurred within ATC work;
- discusses the implications of those changes for accredited and informal learning in the workplace; and
- extrapolates about what these changes might mean for the future.

11.1.1 Change in ATC work

In high-reliability work contexts, change is critical because organisations need to be constantly working to improve safety and because conditions in the environment are in a continuous state of movement or flux (Maurino et al. 1995; Reason 1998). High-3 work organisations that do not look for continuous improvements set themselves up for an “organisational accident” (Reason 1998). However, as will be argued in this Chapter, change does not always lead to benefits or positive outcomes. Indeed, all change has capacity to produce both positive and negative outcomes (Jones 1997). It is argued that the history of previous change provides important insights into likely future directions in this particular workplace as well as implications for other emerging workplaces taking on the characteristics of High-3 work (see Chapter One). The rest of this Chapter, then, will draw on examples of change, and anticipated change, to discuss their implications for workplace learning. For example, Figure 17 shows an illustration of the kinds of equipment and work organisation of air traffic controllers during the 1930s and 1940s when Australia’s civil aviation industry commenced after World War II and was staffed predominantly by ex-war-time pilots. The uniformed men at the counter are likely pilots

Figure 17: The beginnings of civil air traffic control in Australia

lodging their flight plans. Historically, the experience of ATC work has been subject to a number of significant changes since its inception and these changes were arguably just as demanding on those controllers when they were first introduced as the changes being implemented now and planned for the future. The ways in which organisational and technological change have influenced ATC work, as discussed throughout the Thesis, will be used as a guide. Examples of the changes to be discussed in this Chapter are summarised in Table 19. The Table outlines some of the key changes that have occurred within ATC work and their implications for learning, and then groups these in relation to the dimension of work experience (see Chapter Seven) most influenced by the change. These points will be discussed below.

Table 19: Examples of changes occurring within the ATC workplace

EXAMPLES OF CHANGE (S= STRUCTURE; C= CULTURE)	IMPLICATIONS	DIMENSIONS OF EXPERIENCE IN ATC WORK
Greater traffic demands (S) Changes in rules and procedures (S)	Increased intensity Smoother ebb and flow	Temporal
Increased diversity in traffic system & changes in procedures (S) Technological change (shift to more abstract and symbolic interpretation) (S)	Increased variety Shift from sentient to intellectual knowing Decreased autonomy/tighter coupling	Complex
Changes in recruitment patterns (S) Changes in values/histories (C)	Shifts in identities (through) changes in valuing work and work's meaning and group belonging	Affective
Technological change Reduced options to learn sociality of work Changes in access to narratives (C)	Decline in sentient interdependence Increase in importance of systems understanding-intellectual interdependence	Social

11.1.2 Changes in the temporal experience of ATC work

As we move toward the 21st Century there are increasing demands placed on the civil aviation ATC system. As was discussed in Chapter Four, historically, in comparison with the current work environment, the temporal experience of the work was much slower. Greater traffic demands have increased the intensity of work, thus altering the temporal experience of that work. Many older controllers, however, argue that in many respects the work was more difficult and potentially more complex in the past because of the crude forms of technologies available, as the following explains:

We had a number of nasty airline accidents in Australia in the late 1930s. Because there were no nav aids and things were incredibly crude. These accidents, investigations and royal commissions that followed, resulted in navigational aids, air traffic control being founded and everything else. Then just after WWII, we had towers and HF radio and flags and it was pretty crude. You had the war time system adapted to peace time. But once aircraft were flying on the main routes you had very crude Enroute control, messages being passed on bits of paper through the flight service operator talking to the planes on HF. All that hashy radio that we [air traffic controllers] wouldn't lower ourselves to listen to, so the poor wretches in flight service, talked to them all and passed bits of paper back and forth through a hole in the wall. I've seen the photos of it. A

hand appeared - and the poor little wretch with the head phones on, listening to radio Peking, and everything all in this hash, would pass your "climb to 8,000" message to the DC3 between Sydney and Brisbane. And you didn't lower yourself to talk to him. / There were a number of major accidents in '48 and '49. Very bad ones and there was a paranoia in the public about flying. After all this wonderful flying in the war, so comparatively safe, now people were being killed all over Australia / The Royal Commission [into one of the accidents] found that air traffic controllers were plotting him [the pilot] and separating him, but nobody was looking after him. Nobody was actually checking to see if the nav aids worked. / Anyway, the decree was made that no-one looked after aeroplanes after they got in the air. We just separated them, but, did he have enough fuel on board? - that sort of thing - so operational control was born (Int. 41, TOI, Southern District Office).

The number of fatal air crashes referred to in the quotation above, and the concomitant outcomes of the various inquiries that resulted from them, significantly influenced the emergence of the organisation of work within ATC. The temporal pace of the work was mediated by the rudimentary nature of technologies in use, which included the aircraft. A flight from Melbourne to Perth, for example, took seven hours (compared to the current three) and occurred at night to spare the passengers the inevitable air sickness caused by the bouncing around at 7,000 feet in the thermal air currents rising from the Australian desert. The pace of the work changed dramatically, however, with the introduction of jet technology, as the following controller explains.

Because in those days [the 1950s and 1960s] the first jets had arrived and it just broke the back of air traffic controllers around the world. The jets were doing three times the speed of all the piston engine airliners. They were higher, faster, descending into the others. All the jets had international gear which couldn't work the Australian nav aids. So you couldn't get distances from them, you couldn't get anything from them. They couldn't give you any information. So you just had to '*Keep vertical, keep vertical*'. But everyone was obsessed by how expensive these things were to keep in the air. The operating costs of jets is 10 times that of the old DC plodding along. So you had to get them through. So they did these incredible things, / The sort of things they used to do was: the jet would come over the top of the 2 or 3 slower piston engine aircraft and then, keeping vertical, get the jet to do a 180, turn around, sight them, this was by day or night, come at them from the other direction, this is 10 miles from the airport, sight them going underneath him, then descend through them, get below them and come around and pass them underneath and get in front of them again. / And the manipulation and the workload and the talking and being positive '*You know what you're doing*' in something like that. And that was a standard ploy to get the jets through the other traffic. Over the top, 180, sight them, descend through them, back underneath and get in front of them by the runway. And all of this sort of thing was going on all the

time, we don't know we're alive! Because we've [now] got all this gear (Int. 41, TOI, Southern District Office).

The quotation above is also the account provided for the war story the “breakdown of the labouring body”, presented in Appendix 11. In the war story, the above change in the temporal pace of the work wore the controller's mind and body down, such that he was no longer able to continue (see Appendix 11). Jets have continued to go faster and other changes have added to the temporal intensity of the work and those changes are expected to continue (Wickens et al. 1997).

As discussed in Chapter Four, the skies are becoming more congested and technological developments (both in the air and on the ground — see ICAO 1994; Wickens et al. 1997) are leading to greater pressure to reduce separation standards even further. Closer separation standards require faster reaction times to respond to a situation that has gone wrong. These changes are leading to the introduction of procedures aimed at smoothing out the temporal highs and lows within the workload so that peaks and troughs in work-flow are avoided. The implementation of new procedures (such as STARS - see Chapter Five and Appendix 8) makes the work more orderly and routinised, though because of the highly interdependent nature of ATC, a reduction in complexity and orderliness in one sector, has consequences for another sector, as the following Arrivals controller explains.

The Approach still think they are prima donnas and that is it. It has always been the case there. They are trying to make their job easier [to be able to bring an *abinitio* [trainee] straight in onto Approach. They still haven't realised I think that there is a lot more work load now on Arrivals than there used to be — just clearing aircraft in and descending aircraft. Well now it is a lot more work tidying up [for] all the STARS and making STARS work for them [Approach] as well. All the holding is done in Arrivals now. It used to be done some on outer sectors and some on the Arrivals. But, we [now] do a lot of work (Int. 54, Controller, Arrivals, Melbourne).

Because of the interdependent nature of the work, changes in work practice as discussed above have implications for the work of others, since the work-flow is interconnected. They also involve, as the above controller describes, a regularisation of work practice aimed at reducing complexity though this is occurring at the same time as other aspects of the work are getting more complex.

For example, technological developments and the changes associated with industrial reform (see Chapter Four) also changed the nature and organisation of ATC work. As discussed earlier, ATC work was organised across three roles or functions: The air traffic controller who tracked and separated the aircraft (see Figure 17), a flight service officer who communicated the controller's instructions to the aircraft via radio, and a flight operations officer, who liaised with the pilot and

checked that the aircraft was properly equipped before departure. These divisions and job roles continued for approximately 30 years. In the 1980s and early 1990s the work organisation described earlier was dismantled. The flight service role has been incorporated into the role of the controller and the flight operations department has been closed. Their impacts on the work of air traffic controllers have been profound and, together with other changes, have led to an increase in the complexity of ATC work, a reduction in inter-group communication (with consequences for both accredited and informal learning); and a narrowing of opportunities to experience (and informally learn about) the aviation system in general.

11.1.3 Changes in the complexity of work

It has been contended by Zuboff (1988) that technological change impacts on work practice by restructuring the work environment and, in so doing, abstracts thought from action. As technological improvements are implemented in the ATC workplace it has made more information available to the controller and, through abstracting such information, the work is increasing in complexity. Historically, ATC work has moved from one of physically acting on the tools available to one of interpreting the meaning of data and symbols. This section will show how technological development has simultaneously resulted in improvements to information availability and the same time increased work complexity.

One of the most significant changes to the cognitive complexity of ATC work involved the introduction of radar (although it should be recalled from Chapter Four that radar coverage still only exists over a small proportion of controlled airspace). Historically, radar controllers used what were called “bright” displays which consisted of a radar screen with small plastic tags called “shrimp-boats”. The controller would write the details associated with the aircraft (such as its call-sign and flight level) on the shrimp-boat and then physically move the shrimp-boat along the display as the aircraft completed its flight trajectory. In the 1980s, technological improvement resulted in the information the controller had needed to hand-write being automatically made available on the radar screen. These computer-mediated radar screens went through a number of iterations (called “ATCARDS” and “AUSCATS”). In terms of work practice, these technological innovations resulted in two significant changes: the controller no longer needed to physically move the aircraft, pointing out where the aircraft was going to be; and the reduction in the amount of communication needed between controller(s) and pilots, since the information was easily available and did not have to be requested. These technological improvements have since had some unintended consequences for those involved in the accredited learning process, as the following controller explains.

R: It all clicks into place. One of the things we say with the new radar is that it makes it harder to know when they have ‘got it’ now because now we have got the altitude readout of speeds etc, — you can’t see what they are thinking. Before they had to ask. They were always asking aircraft for their speed or an altitude and you could see what they were thinking. Now, you are just sitting there and you don’t know what they are

thinking. You don't know if he got it right by luck and he didn't even see the problem, or if he actually knew what he was doing. The old radar was good like that because it was just good. A piece of basic radar and you had to work. / You don't know as much about what people are doing. Instead of trying to work out what they are thinking. That is why at times you say to them '*What were you going to do here?*', just to find out if they are thinking about it. If you get a dumb answer or a blank look, you know he wasn't thinking about it. If they can come back quickly you know that he has seen it.

I: Whereas before, you could detect by the questions that the trainee was asking?

R: Yes. Things he was saying to pilots and what he was doing. You could think '*Oh yes. He has seen that, he is doing that*'. Sometimes you couldn't, but often, it was far more obvious what they were thinking. When you are looking at a situation going wrong, it is really nice to know whether or not he is thinking what is going wrong or is he thinking about something else and hasn't seen this is going to go wrong (Int. 67, Instructor, Approach, Brisbane).

The advances of technology in this case make the thinking of the trainee opaque to the instructor, who then has to use other methods to determine the trainee's planning, thinking and decision-making. However, as will be recalled from Chapter Nine, communicative strategies such as asking questions are bound up in cultures of practice where trainees seek to project confidence and instructors seek to imbue it. As will be recalled from Chapter Nine, for some trainees, revealing what they do not know is difficult and for some instructors, asking a question about the trainee's intentions may send an undesirable message, since to do so indicates the instructor is not comfortable (or confident) with what the trainee is doing. As will be discussed below, these changes in technology leading to opacity are also leading to greater abstraction.

11.1.3.1 The abstraction of ATC work

The move from shrimp-boats to a computer-mediated display changed the relationship between thinking and action for controllers because these cognitive processes were now mediated by symbols and data available on a screen. The symbols being interpreted, however, have remained until now a "real-time" representation of the air traffic pattern the controller was working with at the time. Under the next technological development planned for the near future (TAAATS), the interpretation of symbolic data generated by the computer takes on even greater importance, as real-time work is differentiated from that which has been planned and projected. In the following quotation, the controller is discussing how on some sectors (radar) the controller will have on the screen a real-time representation of the traffic pattern in the air. This is in contrast to the situation presented to a colleague nearby working a procedural sector who will have exactly the same screen, though the representation will be a computer generated image of where the computer (based on the information provided to it) has positioned the aircraft. The visualisation referred to at the beginning of the quote refers to what procedural controllers need to do at present (turn the information presented on the flight strips into a picture of the traffic pattern).

R: You won't have to visualise up here [head] any more — you'll be able to see it all on planned display. But a lot of the areas [i.e., in Enroute] it won't be where the aeroplanes are, as where the computer thinks they are and people are going to start, maybe, thinking, especially if they work here [Enroute procedural] one day and they work over there, which is a radar position, another day of their team. They could, in their heads, think that when they're here they're [using] radar / but it's not a radar as such. So there's huge cultural, human factor type problems involved in that and I think that's kind of exciting/

I: So at the moment somebody might be sitting on a radar [position] and the planes are where they look like they are and then on another day they'll be sitting at a computer at a screen

R: And it's the same screen. It looks exactly the same! It's exactly the same screen.

I: But in fact it's where the computer thinks the planes are, rather than ...

R: Based on the information it's been fed. Now there are different symbols to display that like a [inaudible] will be a blip and that's where it [the aircraft] is. And then if it's a predicted position based on, say, the flight data or the plans and it's just updated by somebody well then it [the aircraft] will appear as a different symbol and it will move across the screen and all the rest but that's just a change in a symbol (Int. 34, TOI, Southern District Office).

Under the new TAAATS system, computer-mediated Enroute procedural control will not be undertaken using paper strips on a flight progress board (see Chapter Four), but instead will be undertaken using a computer display, which is a facsimile of a "real-time" radar display. The display is not a representation of where the aircraft are, according to the radar, but is instead a computer generated image of where the computer-based information anticipates where the aircraft is, or will be. The difference in whether the information can be interpreted as a real-time radar display or a computer generated image will be in the kinds of symbols used on the screen. These changes require an increase in the interpretation of the meaning of data and the development of strategies for data interrogation to determine the reliability and authenticity of that data.

The implementation of TAAATS will also involve a greater degree of abstraction and interpretation than is necessary at present because there will be an increased variety of symbols for the controller to interpret. This will be exacerbated by a greater variability in the standards and procedures to be applied to aircraft with differing technologies (and demonstrated on the computer screen by different symbols). Some aircraft, for example, have their own forms of surveillance and radar detection equipment on board (such as Collision Avoidance Systems), but not all aircraft flying through controlled airspace have these technologies. Aircraft (and airlines) investing in such technologies wish to gain full advantage of such systems which means a desire for smaller degrees of separation and greater flexibility in terms of, for example, flight path

trajectories. In response to demands from the aviation community there are also now differing airspace procedures on some airspace sectors. In some airspace sectors, some aircraft can choose to be fully controlled and separated by the controller, and others can choose to just receive a "radar advisory service" (similar to that which used to be provided by Flight Service Officers but are now part of the role of the air traffic controller). These differences in aircraft technologies and procedures will be indicated on the radar screen by different symbols. Within TAAATS, there will also be other information the controller will have to interpret, as the following controller explains:

R: A workplace controller needs to know more about the system and the implications of the system when something he does is not done properly because everything feeds on the system. This '*feeding the elephant*' phrase that came up in Paris. If you don't feed the elephant [input data into the automated system] then someone else is getting the wrong idea and is acting on information that is wrong, but the computer thinks is right because no-one has told it otherwise./

I: So that's system awareness of the system and implications of the system?

R: Yeah because it's central. Everything around TAAATS works around this system and they continually cross check each other the [inaudible] data thing and the flight data thing. They're always linked, everything's linking in and updating everything else automatically. So I could change something on a strip and that'll flow through for the rest of the flights and alarms and bells won't happen at the other consoles to say '*this has changed*'.

I: Even though you might have changed it? It won't change [in] any other place?

R: Oh, it'll change. Like a guy could look at it and he'll see 330 [flight level] or something like that and I could change it and it'll change it to 350, but if he's thinking 330 because he hasn't looked at it since there's nothing to alert him, whereas before I would have had to ask him (Int. 33, TOI, Southern District Office).

These changes in the abstraction of information work through the interpretation of data and symbols, require different skills in interpreting information and symbols and will be discussed later in the Chapter.

Signalled in the controller quotations above is the issue that computer-mediated interdependent work requires a greater need to recognise the impacts of one's actions on others and to interpret data-driven information from the perspective of the totality of the whole system. In the past work that influenced the work of someone else would require contact through direct communication. As technological improvements have been made, this requirement has been reduced so that work at the new data interface (Zuboff 1988) updates such information automatically and silently. The implications of these factors to the sociality of work will be discussed later in the Chapter. The technological changes discussed require modifications in thinking and interpretation of data. They increase the variety of information available (and

“noise” in the system, since there is more information to differentiate between what is important and what is not) and they will require different skills in interrogating data. Such change is also affecting the ways in which controllers make sense of their work and the identities they generate from being involved in their work.

11.1.4 The affective experience of workplace change

Although ATC work may become temporally more demanding and is taking on greater abstraction through interpretation of symbols, recent past changes and planned future ones are perceived as deskilling by the existing work force because they are believed to render what was a difficult and dangerous job easier. The following controller explains this as follows.

R: The job now is so regimented, you don't have to think as much as you had to in the past. Sure, in the end it will probably be a lot safer, but there were very few incidents on Approach before, because you had to be good to get a rating.

I: So is it deskilling?

R: Deskilling! That's what they want. They want deskilling so that anyone can get a rating and it solves a lot of staffing problems. [The job], it's now like sitting and watching the grass grow. Approach used to be a really good job, all the guys loved it. I mean it was bloody hard work, before ATCARDS. It was a very very difficult job, with a green screen and shrimp boats and no altitude readout and no ground-speed. It was horrendously frightening to the uninitiated and it was very very hard work, [but] it was very satisfying. This system's made it a lot easier — altitude readout and ground-speed and stuff like that — has made it so much easier. But the regimentation now is going to make it so much easier still so that they will be able to take people and make them into Approach controllers or Departures controllers, fairly simply. I don't see that as a really bad thing, I just find it demoralising to the people that's there (Int. 125, Controller, Approach, Melbourne).

For this controller his identity has been based on his capacity to do a really hard job, and one that was frightening to “*the uninitiated*”. For those who worked under these past conditions, existing and planned work practice devalues the skills of the operator because technological aids make the work easier and procedures remove the autonomy the controller once had to make decisions. As the following TAAATS Operational Instructor explains, these changes are likely to continue with the new system:

I: What are the negative bits of TAAATS?

R: I think deskilling. I get some pride in knowing I can do a difficult job not many people can do and I can do it well, touch wood. I rely to do that on my experience and I rely on my knowledge of the rules, but I think it's basically experience, because I've been caught before so I don't get caught again. / With TAAATS the system can look ahead for you, if you allow it to. And it can even suggest ways to do things or ‘*when you do this it*

will affect this and it will flow on down the line', and so take a lot of that skill out of the job. The procedural control, this mental visualisation of a three dimensional picture is gone because you have a two dimensional display and you can actually see not where they are but it's the same as what you see in your head (Int. 36, TOI, Northern District Office).

For these controllers changes in the level of sophistication of the technology in use leads to a perception of deskilling because their judgement is no longer the central element in decision-making. Decisions are instead mediated by technologies that can aid the controller in undertaking these tasks. Changes affecting the meaning controllers derive from their work, their satisfaction and valuing of their work have also occurred as a result of other organisational changes, such as flattening hierarchies and introducing team-work, and these also affect the ways in which they work with others. The status of this social identity then, has been eroded through these structural changes, and has led to resentment on the part of group members, with negative impacts for informal learning as the following controller explains:

I: So you don't like teams then?

R: We're all supposed to be part of the same team, but if you've noticed, there's a huge division between the Tower and these guys over here on Approach and there's a huge division between Approach and the rest of the room. We are the prima donnas and we carry on like prima donnas. A lot do, and now, everyone used to aspire to go onto Approach and that doesn't happen any more because of the salary compression. So now they find it difficult to get Approach controllers. And now there's resentment from the Approach controllers to the people on the other side of The Room. Not the people individually but to the fact that they are getting paid as much as we are in some cases more and they're just out of nappies and it really has got up a lot of guy's noses. So people on the other side of The Room often get the cold shoulder and they [get] '*Go and ask your team leader*' when they're asked a question, or something like that '*You're getting paid as much as I am, go find out for yourself*'. And they don't learn anything any more and very rarely do we have people from the other side of The Room come over and want to sit with us (Int. 125, Controller, Approach, Melbourne).

The quote above highlights some of the impacts of change on opportunities for informal learning. For controllers on Approach part of their social identity developed historically from having worked their way around The Room, always aiming to do a harder job. Having succeeded in undertaking the hardest job, that job, through policies such as STARS and the flattening of the organisational hierarchy, is perceived by Approach controllers as being deskilled and as something not aspired to by others in The Room. The dangers for processes of informal learning occurring within The Room are evident in these contested cultures between Approach and the rest of The Room and have been discussed elsewhere (see Chapter Five).

11.1.4.1 Changes in recruitment: Narrowing the bandwidth of experience

These changes in technology and work organisation are not the only changes occurring within ATC that impact on the affective experience of ATC work and performance. Changes in recruitment, for example, have influenced the level of aviation background of controllers. For the first few decades of civil aviation in Australia recruitment included ex-war-time pilots and those already involved in aviation. Australia's first "professional" air traffic controllers (where there was no formal requirement to have a background in aviation) occurred during the 1960s and up until the late 1980s those without an aviation background undertook a two year training period (see Chapter Four). Yet, many controllers and trainees still had affiliation with the aviation community (see Chapter Five).

Historically, many controllers developed their knowledge about ATC work and its relationship with the rest of the aviation system by informal means: either they already had knowledge of aviation because they flew aircraft in their spare time, they were part of a family where other family members were involved in an aviation-related occupation; or they had come from a related job overseas or in the military. Changes in recruitment practice have changed the nature of the experience controllers can draw on to understand the implications of work activity for the broader aviation community. The following excerpt illustrates the perceived difference between those controllers with many years of experience who have been recruited from "within" the aviation sector and those who, as a result of changed recruitment policy, have joined more recently.

It's a funny culture now. When I first started off in ATC, and I started off with the air force, and then I transferred over to what is now the ASA. To actually do the job, you had to have some, you had to have an interest in aviation. You used to have to love aviation and love aeroplanes. Nowadays, people do it because they saw an ad in the paper and they say '*Oh yeah, I'd like to do that*' and they go in and they pass the psych tests and the aptitude tests because they're bright and pretty brainy, and they do their course, and they come out and they do their rating and they're at the window and they see an aircraft taxi past and they say '*Is that a 737 or a 767*' or something like that, and they don't know the difference between aircraft, because they had no requirement to have any interest in aviation (Int. 106, Instructor, Enroute, Melbourne).

These changes are resulting in controllers entering the aviation system with less background knowledge about the aspects of the aviation system than their previous counterparts with the consequence that they are on a much steeper learning curve than would have been the case for their predecessors with a background in aviation. These changes are coinciding with a decline in opportunities to informally learn about the aviation system.

11.1.4.1.1 Breadth of content knowledge: Learning about the aviation system

In addition to changes in recruitment practice, there have also been changes in the duration and content of pre-workplace training programs (see Chapter Four). Economic and political pressures exerted on the organisation in the early 1990s (see Chapter Four) have led to a streamlining of course content with removal of “nice to know” material, with a subsequent reduction in time taken in training. It is contended that these changes are leading to controllers being competent in job tasks and job performance, but who have less understanding than their older, more experienced counterparts, of the relationship between the controller’s role and the roles others play within a complex aviation system. The following quotation from an “old hand” summarises concerns held about the level of background aviation knowledge held by newer controllers.

We did a two year course and went out into the field and we did airline attachments and we did out-station attachments and we went to RAAF attachments and all sorts of things. We got to know about aviation. I already knew it because I had a pilot’s licence before I joined. You got right into it and you met the pilots and you flew in the aeroplanes and you checked out the [aircraft] profiles and all sorts of things. There are guys [in The Room] now who have never even been inside the control tower. They have come out of the College and / They have never been inside a cockpit of a jet or anything else like that. They don’t know what an aeroplane does. What it looks like. It is just a blip on the screen that goes so many knots. Then you have even got to tell them how fast they go. *‘How fast does he really go?’* and you say *‘Well he does this, that and the other. The cockpit looks like this inside, visualise what’s inside the cockpit. The pilot hasn’t got a control panel, just a little stick on the side.’* *‘Oh has he?’* Just little things like that and get them to visualise what’s going on. At the moment it’s just a production line (Int. 71, Instructor, Arrivals, Brisbane).

The narrowing of opportunities to learn about the aviation industry as a whole have also been expressed by others working in the aviation industry in general. Anecdotal evidence suggests that recruitment and training strategies for pilots, for example, have undergone similar changes. In the past, many pilots learned to fly in aero clubs and flying schools whereas the new generation of pilot is being trained in universities. Changes are leading to increased specialisation together with a decline in opportunities to informally learn about particular aspects of the aviation system and one’s role within this system. For some, this is perceived as leading to changes in the attitudes of some controllers and what can be described as a detachment determined, in part, by an increasing tunnel vision in the enculturation of controllers.

11.1.4.2 Tunnel vision

The processes by which people informally learn as part of their everyday work practice have also undergone change. When individuals undertake their work tasks they learn not only about those tasks, but to some degree, about the ways in which those tasks impact on the work of others. In

organisations where people move through various job roles, there is an increased likelihood that those individuals will gain a greater understanding of the "requisite variety" (Weick 1987) within the system. Learning about ATC and the aviation system was also informally enabled by the variety of roles controllers could play within the work organisation. These included, being involved in other parts of the air traffic control system (e.g., flight operations), or working at a country airport (or "out-station"). These opportunities are no longer available as technologies have been developed to replace the activities that once needed to be performed by people and can now be performed automatically by machine or undertaken remotely by someone at another location. As discussed earlier, the flight operations department was closed in 1991 as part of a policy to reduce the labour force (and associated costs - see Chapter Four). This was the place where pilots (and their representatives) would either contact or visit to lodge their flight plans. The technological capacity was then developed where pilots and airlines could lodge these automatically. The following quotation, describing the impact of the closure of this part of the ATC work organisation, illustrates the narrowing of work experiences referred to above:

At the stage that I first went to the [ATC Centre] we were running briefing offices at every general aviation aerodrome around the country. The purpose of the briefing offices [was] two fold. One is the provision of flight information for pilots/ like normal flight planning procedures. The second one was/ pilot education. It provided a link between air traffic services, air traffic controller flight service and the pilot. So that the pilot could go out, if flying around, [and] maybe not clear about something when they came back, they'd call in the briefing office and have someone clarify. Or maybe they did something wrong. Instead of a rather impersonal sort of phone call of whatever, it was quite common to ask a pilot to report to the briefing office so he could sit there and he could actually go through what the problem was and possible ways that they could solve that problem. It [was] an education tool. There's a huge advantage to this. That was our main interface with general aviation. We closed all our briefing offices around the country. / But immediately there was a noticeable difference to me. / you immediately lost that contact, face to face contact you had with pilots. Because everyone worked the briefing roster. You'd be over there, you might have to do one shift in 5 or 6 or something. But at least if you're in the briefing office you get to know the pilots as they're coming in, you talk to them. They know you, they recognise voices when you're talking to them on the radio./ So that went. It was a great loss to us (Int. 34, TOI, Southern District Office).

Clearly these changes have been introduced for the betterment of the aviation system and in most cases this intention has been achieved. However, what the above discussions reveal is a fundamental shift in the nature of training and enculturation occurring within the ATC workforce. The combination of changes in policy, technological capability, downsizing and centralisation (see Chapter Four) is resulting also in an "homogenisation" of experience with consequences for informal learning. For example, as a result of the introduction of regularisation

of work practices, it is contended that those controllers working the Enroute sectors with fewer years of experience also have had less variety (i.e., a team of seven members would have potentially seven experiences of the one year rather than decades of different kinds of experiences). These changes, then, are limiting and narrowing the experiences controllers can have to learn about their role in an increasingly complex aviation system, at a time when work complexity, data abstraction and tighter coupling of job roles through automation make understanding the various aspects of the aviation system and their inter-relationships even more imperative (ICAO 1994; Maurino et al. 1995). Therefore, trends to centralise work, that reduce the variety of experiences people can have lead to a situation where there is likely to be a reduction in the variety of experiences people can draw on to understand the nature of their work.

11.1.5 Changes to the sociality of ATC work

It is contended that within complex work systems, people need to have a greater understanding of the socio-technical nature of the work: the interdependence of those social and technical systems; and the implications of such interdependencies (Hughes et al. 1992; ICAO 1994; Maurino et al. 1995; Tompkins 1997). However, as has been argued, the way people in ATC have traditionally worked and learned about the inter-relationships in the aviation industry is also going through fundamental change. What is important here, however, is not just that changes are occurring to the interdependent nature of the work, but that the ways in which individuals learn from each other through the sociality of the work experience, in their everyday work practice, is also going through fundamental change. Table 20 summarises some of the changes discussed so far and their implications for the sociality of work.

The changes outlined in Table 20 represent a fundamental change in the transformation from one technological system to another. Before discussing the changes in the sociality of work that come into being with the implementation of TAAATS, it is useful to compare the work configuration of TAAATS with the past. Figure 18 shows the operation of the TAAATS console. Compare Figure 18 with Figure 16 *The sociality of ATC work*, (page 150) which demonstrated the historical means by which controlling work was undertaken in concert with those nearby.

Table 20: Changes to the sociality of ATC work

Sociality of ATC work	Historical purpose	Change
Third ear	To monitor transfer of information	Decline - limiting of direct communication
Body clock	To monitor ebb and flow of work and one's own anticipation and limitations	Decline - reliance on technological aids, alerts
Referential anchoring. Build up work activity/ paper strips	To plan and anticipate what work may be building	Decline - automatic computer data transfer
Physical organisation of work	Capacity to observe and reflect on others work, use in anticipation and building in redundancy	Decline in social cognition. Less easily visible physically, more visible via computer screen
Cultural artefacts - narrative	To share the experiences of others, to transfer and build collective memory	Reducing, sharing increasingly limited

Figure 18: Airtraffic control at the TAAATS console

The primary means of gaining understanding, as currently practiced, through the sociality of work were discussed in Chapter Seven and include elements such as the “third ear”, the “body clock” and referentially anchoring work based on the work activity of those nearby, as evidenced in indicators such as the build-up of paper strips. For example, the “third ear” was used to

monitor the transference of information from one controller to another, via the pilot (see Chapter Seven). Access to these social dimensions, important for the performance of work, will no longer be available at the new data interface. As outlined in the above Table, these ways of experiencing the sociality of work had a purpose. Historically controllers built up their understanding through sentence - the sentient know-how gained of working physically in concert with others. Interdependent sentence (see Chapter Seven) was built up through the use of the body and other artefacts as contended by theorists of distributed cognition (Hutchins & Klausen 1996; Pea 1993). Interdependent sentence was also available through social cognition (Resnick et al. 1993) where the work involved physical peripheral cues that were publicly available and accessed through working in close proximity.

Work within TAAATS (Figure 18) has less opportunity for the social cognition (Resnick 1993) indicated in Figure 16. Controllers will still be able to observe the work of others, though not using the typical strategies used and outlined in Table 20. It is possible, for example, with a computer-windows menu for the controller to scan nearby sectors in order to view what nearby traffic may be anticipated. The loss of physical peripheral information, however (see Table 20), through the use of the body, to the extent that it can be argued that these are salient to the success of the work, will need to be replaced by other cues, because the complexity and automation within the socio-technical system still demands awareness about the interconnectedness of roles, relationships and responsibilities.

Before moving on to a discussion about what those future challenges may require, there is one more change to be discussed in this section. This involves the changes in cultural practices of informal learning through sharing war stories.

11.1.5.1 Changes in centralisation and impacts on informal learning through cultures

Changes as a result of the centralisation of work organisation, for example, have led to a concentration of people into two Centres, and the use of teams has enhanced the development of sub-cultures based on sector work. One of the consequences of these changes has been the reduction of opportunities for controllers from different sectors (and different levels of experience) to meet. The concentration of work practice will most likely lead to stronger team-based sub-cultures, and this may or may not be an advantage depending on the communicative practices of the team, though there is also an unintended consequence of such centralisation. Changes are occurring within one of the cultural ways in which controllers informally learn about their workplaces - through war stories. As discussed in Chapter Eight, war stories, play a key role in enhancing understanding because someone can hear and learn from the stories of others' experiences. Stories remind people of the key values on which they and the collective operate. When people share stories, they enhance the potential for requisite variety among controllers. Stories are important because they register, summarise, and allow reconstruction of scenarios that are too complex for logical, linear summaries (such as a set of regulations) to preserve

(Weick 1987). The centralisation of services to two locations and the concentration of work into teams is having a negative impact on the ways in which stories are shared and transferred in ATC and, hence, on the understandings controllers gain from those stories, as the following quotation highlights.

It amazes me that those sort of stories the younger guys haven't heard / I suppose the ones who have come into The Room, if they don't know you because of the set-up that is up there now, if they don't know you, they haven't heard the stories about you. It's the likes of us who knew all the old-fellows-who-were-anybody years ago, and we have heard all their old stories. / There doesn't seem to be as many of the stories about people and we put it down to the fact that The Room up there, you could work up there and not know half the people in the room. Whereas, the way it was when I said there was Approach, Arrivals and two [Enroute] sectors — you knew everybody. When I first went to Brisbane, I prided myself in that there weren't any controllers in Brisbane that I hadn't met or didn't know. / I knew everybody else in Queensland or had met them or seen them or something. Now I couldn't because there is so many of them. I think that is part of the problem - you don't know the people any more (Int. 71, Controller, Arrivals, Brisbane).

Changes and centralisation of services and expansion of The Room and its workforce are leading to a reduction in the cultural practice of telling war stories. As was illustrated in Chapter Eight, stories provide a means of collective remembering. They enable experiences of an organisational system to be shared vicariously. However, war stories also play a boundary spanning role because they allow for the integration of understanding across controllers working in other Centres and in other teams to engage in other processes of learning vicariously through the experiences of others and to learn what can and cannot be done within a system of high reliability. A reduction in this informal means of learning reduces the understanding controller have of their work and the ATS system.

11.1.6 Conclusion: Where to from here?

Just as technological change increased the temporal flow of the work in the 1950s, the technological developments occurring at the end of the 20th Century look set to continue increasing the intensity and pace of work. The changes discussed above also signal an emerging complexity as the work increases in its reliance on interpretation of symbols and abstraction of information. Together with these changes have come shifts in the ways in which people acquire knowledge informally through work activity in air traffic control. Significant changes in the nature of work are resulting from the introduction of more sophisticated technologies. Technological change is leading to a tighter coupling of job roles within the ATC system. The trajectory of these changes lead to the conclusion that the future of ATC work in particular, and High-3 work more generally, is likely to have the following characteristics:

- to be more temporally demanding, though more regulated;

- to be more complex in terms of interpreting symbolic information as a result of the variety of data available;
- to lead to shifts in the ways in which individuals can gain their needed background knowledge;
- as a result of technological change, to a decline on the reliance of sentient know-how;
- to increase the demand for the development of intellectual skills (skills in data reading and interpretation);
- to increase the demand for systemic awareness and understanding of the impacts of work roles within tightly-coupled, computer-mediated information systems;
- to have stronger ties to teams but with weaker ties to broader work or occupational groups.

The key question, then, is how will people working in tightly-coupled, interdependent, computer-mediated environments gain the information necessary to do successful work? A comparison of the new ATC work configuration reveals the decline in sentence as an obvious means of engaging in the sociality of ATC work. As has been discussed, however, there is a greater need than there has been in the past, for those actors within these work systems to have a systemic understanding of the linkage between their work and the work of others. It is contended, therefore, that these changes within the ATC system signal a shift in skills needed from sentient to intellectual interdependence.

11.1.6.1 **Toward intellectual interdependence**

“Intellectual skill” is a term coined by Zuboff (1988) to refer to the capacities individuals need when working within complex symbolic information. According to Zuboff:

Intellectual skill ... encompasses a shift away from physical cues, toward sense-making based more exclusively on abstract cues ... and procedural, systemic thinking. Intellectual skill works through the problem of symbolic meaning at two levels. First, it establishes the referential power of symbols and thus provides them with legitimacy. Second, it uses the symbolic medium to ascertain the condition of “reality” in ways that cannot be reduced to correspondence with physical objects (for example, the ability to discern states, trends, underlying causes, relations, dynamics, predictions, sources of sub-optimization, opportunities for improvement et cetera). A theoretical conception of the total process is essential if intellectual skill is to be successfully applied to the problem of meaning in this way (pp. 95-96).

The thinking involves abstraction, interpretation, and inference where task relationships are mediated by an information system. Meaning is refracted through the “symbolic medium of the data interface” (Zuboff 1988, p. 70). Zuboff (1988) claims that the development of intellectual skill requires that two challenges be confronted: the challenge of the interpretation of symbolic information and the challenge of discerning its meaning. It is argued in this Thesis that work within tightly-coupled, interdependent systems adds another dimension – the need to develop

and maintain a shared awareness with other actors working in the system. This is particularly important, as research (Wickens et al. 1997) suggests that technological developments, such as automation, are having a negative impact on maintaining situation awareness (Endsley 1994). Where one's work is inter-connected to the work of others, such work requires heightened communication with others. According to Zuboff (1988)

... a fundamental quality of this technological transformation ... involves a reorientation of the means by which one can have a palpable effect upon the world. Immediate physical responses must be replaced by an abstract thought process in which options are considered, and choices are made and then translated into the terms of the information system (p. 71).

When working is no longer reliant on the body and easily visible on physical artefacts for its representation, new cues need to be found. Unlike interdependent sentience, where physical cues could be noted implicitly, and interpretations based on tacit understandings, when work is mediated by a collectively shared information system, communication needs to be made deliberately explicit (Orasanu 1995; Galegher, Kraut & Egidio 1990; Salas et al. 1995). In understanding their intellectual work, operators need to recognise the interdependence of that work. The interpretative processes required depend, therefore, on creating and sharing meaning through inquiry and dialogue. If the information is not socially available, more direct means need to be found to explicitly share and test out understandings and possible plans of action. This requires, therefore, a shift in emphasis from social to shared cognition. That is, these emerging work environments require communicative practices associated with enhancing and expanding the amount of relevant information available so that individuals can successfully undertake their work in concert with others.

At the heart of intellectual interdependence are the practices of inquiry defined in this Thesis as supporting informal learning. These communication skills are necessary to maintain a shared situation awareness (Orasanu 1995; Blickensderfer, Cannon-Bowers & Salas 1997). Intellectual interdependence is a process which assists in crossing the boundaries of the interface between operators in the work system, as their work is mediated by technological information system. What kind of work environment would need to be created in order to support intellectual interdependence through practices of continuous learning? The answer to that question is teased out in the next Chapter.

Chapter 12

Conclusions, implications and future work

Chapter Twelve addresses the final research question “How might workplaces be designed to create possibilities for practices of continuous learning and development of educative environments?” It commences by defining what is meant by an educative work environment and then moves to synthesise the findings using a model presented to discuss the ways in which organisational structures and cultures enable and constrain learning in the workplace. A discussion of the implications of the findings is then provided for two audiences: those involved with facilitating workplace learning and those involved in organisational design. In this way the discussion and the model presented aim to establish a bridge between learning and organisational theory. The Chapter concludes by suggesting future directions for further research.

12.1 Introduction

As discussed in the last Chapter, there have been significant changes within the workplace and organisation studied. The changes occurring within ASA are indicative of the kinds of transformations occurring within many organisations world-wide. The aim of this Thesis has been to explore the impacts of changing contexts on learning in the workplace. In Chapter One, it was contended that learning in workplaces is important because it is through work that human beings have the possibility to contribute to the common good and in so doing to learn and develop through adulthood, and because learning in the workplace has been identified as a key factor in organisational success in changing and uncertain environments. This is arguably nowhere more important than in High-3 work environments where learning is not just a factor in organisational success, but plays a key role in enhancing reliability and safety in such environments. This Chapter concludes the Thesis and addresses the final research question:

- How might workplaces be designed to create possibilities for practices of continuous learning and the development of educative work environments?

The Chapter:

- defines what is meant by an educative work environment;
- synthesises the findings presented in the Thesis to review the ways in which cultures and structures enable and constrain learning in the ATC workplace;
- discusses the implications of these findings for workplace learning facilitators and organisational developers interested in developing educative work environments; and
- suggests directions for further research.

12.1.1 An educative work environment defined

An “educative work environment” is one where there is a “striving to maximize learning in the workplace through the way work, decision-making, technology and related processes are designed, maintained and redesigned. It includes the structuring and evaluating of work relationships based on their individual and mutual learning and knowledge-creation potential” (Kornbluh & Greene 1989, p. 258). The notion of an educative work environment is important to this Thesis because it focuses on the importance of creating environments for human learning and because it draws attention to the influence of organisational structures and processes on human well-being. It is argued that organisations need to be assessed in terms of their educative possibilities (Kornbluh & Greene 1989) and evaluating workplaces in these terms is a theme that is now addressed in this Chapter. Learning in the workplace has been defined in this Thesis in two ways, as accredited formal learning and as informal learning that occurs as part of everyday work practice. It is argued that both are necessary to create educative work environments as defined above.

The experiential learning theory of Kolb (1984) has been used in this Thesis as a framework to analyse the influence of contexts on both accredited and informal learning, because it emphasises process and also because it highlights the importance of considering learning as an iterative endeavour that can occur in a continuous cycle. Kolb's theory draws attention to the importance of experience, reflection, conceptualisation and experimentation as necessary components of the process of learning. In changing organisational environments, such a model is particularly useful because it addresses 'how' learning occurs, rather than 'what' is learned. It is contended that this is valuable because needed job content in workplaces will change in the future and will change across contexts.

Educative work environments would support processes of continuous learning when structures and cultures enable the four processes to occur and support them. Indicators of continuous workplace learning, then, include the ways in which people in the course of their work, have opportunities for learning structured into their workplace experience and have opportunities to reflect on what occurs in their work practice, to make sense of their experiences through interpretation, to generalise those insights to new situations, and to try out new ideas. Accredited and informal learning involves practices of inquiry such as asking questions, seeking information and gaining feedback. As already discussed in this Thesis, these activities can occur at the level of the self (i.e., self-inquiry); in situated activity with others (e.g., asking questions, seeking feedback, sharing ideas and interpretations), and can be embedded within organisational artefacts (e.g., where these are built into ways of organising). The notion of an educative work environment, then, is one where there is constant striving to create opportunities for continuous learning through focusing attention on the cultural and structural context that support such learning processes. Evaluating workplaces to assess the ways in which they maximise learning requires that we explore how each of these processes are enabled and constrained within the workplace environment. This has been the focus of the Findings Chapters (Seven to Eleven) presented in this Thesis and those findings will now be synthesised so that their implications can be considered for the development of educative workplaces.

12.2 Synthesis of findings

The first research question, addressed in Chapter Five, was: "What structures and cultures can be identified within the workplace studied?" Chapter Five showed that the ATC workplace is governed by a highly formalised, complex, organisational structure, that involved a variety of strategies for work differentiation and integration. A high degree of formalisation was evident in the kinds of rules and procedures that are in place to govern everyday work activity. Throughout the Thesis, evidence was provided showing how this element of organisational structure is increasing. That is, that tighter controls are now in place governing workplace activity than have been the case in the past. Nevertheless, there is still a reasonable degree of autonomy and decision making in the micro-practices of ATC work. Changes to formalisation also have been accompanied by centralisation of work practice and this has resulted in a concentration of work

activity in two Centres, and a closure of other parts of the organisation where air traffic controllers have traditionally worked. Chapter Five also detailed a range of modifications to structures associated with the differentiation and integration of work activity and these included: multi-tasking; the flattening of organisational hierarchy; and the introduction of team-work. The physical layout and operation of work was also found to be a salient feature in structuring work activity.

The cultures of ATC work were also analysed. Chapter Five concluded that there were three key values and beliefs collectively held in ATC that govern work practice and these are based on the importance of ability, performance and confidence in successful ATC work. Individual and collective adherence to these beliefs established particular norms of practice, and also permeated other cultural artefacts such as the informal language used to share understanding, the transfer of information and memory through narrative about past experiences, and in collective stereotyping and labelling of certain forms of behaviour. Adherence to these beliefs and values was not found in all work-groups and the degree to which they were collectively held determined in-group and out-group behaviour and was manifested also in contested cultures within the workplace. This finding is similar to other studies where culture was found to be an important mediator of work performance (see Bierly & Spender 1995; McAuley 1994; Helmreich et al. 1998).

The findings presented in this Thesis demonstrate how both structures and cultures influence learning in the workplace in many ways, some of which are easily discernible and others that are less so. For example, it was shown in Chapter Five that structural aspects of work organisation may position individuals into certain groups by concentrating their experiences within those groups. This leads to enculturation and identification with certain work groups and collective beliefs, values and norms which influence the interpretation of individual and collective experience. The language used in ATC revealed historical lineages with particular occupational identities such as those found within the military, or within the broader aviation community. The narratives shared within work cultures were found to provide a means of collective remembering and a means by which others could learn through the vicarious experience (Bandura 1997) of others. It was contended that the myths held by groups represented the projected idealised experience (Czarniawska 1997) of individuals and groups because they were found to reflect archetypes of identity (a positive identity in the form of the Gun Controller and a negative identity in the form of the Adrenalin Junkie). Like collective belief and value systems these "shared group self-images" (Hendry 1996, p. 624) can both enable and constrain learning, constraining if they remain untested and this issue was the focus of the second research question addressed in this study.

Chapters Seven to Ten addressed the next research question: "In what ways do organisational structures and cultures enhance and inhibit learning in the workplace?" Examples were drawn from both accredited and informal learning and each Chapter focused on a particular aspect of the learning process as described by Kolb (1984): experience, reflection, conceptualisation and

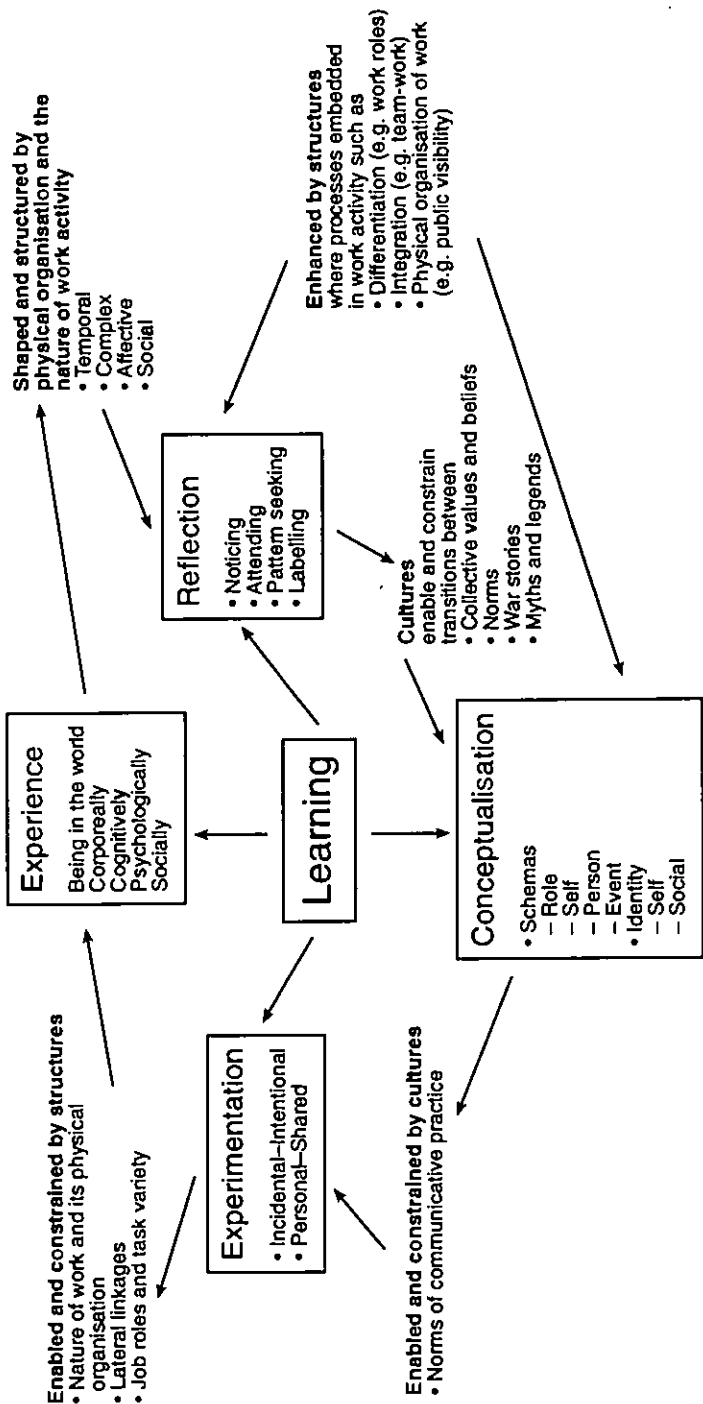
experimentation. The influence of structures and cultures on the various processes of learning are illustrated in Figure 19.

The Figure presents a model of the conceptual framework outlined in Chapter Six. It is contended that the extent to which these structural and cultural contexts enable and constrain either engagement in a particular process of learning, or the transition from one process to another, depends, in part, on the combinations of contextual features present at the time.

The model presented in Figure 19 extends the work of Kolb (1984) by showing how contextual elements mediate engagement in, and transition between, the four processes identified as important in learning (see Chapter Six). The Figure shows how the physical structuring and the nature of work activity emphasised certain aspects of experience, notably the temporal, complex, affective and social dimensions. These dimensions of experience were found to then mediate the transition to other elements in the learning process. For example, the physical organisation of work influenced the transition between experience and reflection, and engagement in reflection, because such processes needed to be delayed and were often opaque or fuzzy given the complexity of tasks involved. Cultures also influenced reflection, and the transition between reflection and conceptualisation, because collectively held values and beliefs mediated what was attended to and interpreted within particular work activity. This was found in both accredited and informal learning. Cultures and structures also influence the transition between conceptualisation and experimentation in a similar manner and the incorporation of these processes into new experiences. By using the framework of Kolb (1984) in this way, the Thesis integrates concepts from psychological learning theory with sociocultural concepts as well as linking them with key ideas from organisational theory, in terms of structures and cultures. The four specific processes of learning will now be discussed.

Chapter Seven showed how the physical structuring of work activity emphasised certain dimensions of work experience, and it is claimed these characteristics are likely to be found in most High-3 work environments. The physical structuring of work required controllers to use various aids to performance and included their bodies and the tools with which they undertake their work and their relationships with others. These findings support the literature on distributed cognition which argues that cognition is not solely the property of the minds of individuals but is distributed or “stretched over” the individual, other persons, and the symbolic and physical environment (Pea 1993; Salomon 1993; Hutchins & Klausen 1996). From this perspective, work involves interaction with a range of objects and displays that function to support ongoing work. Distributed cognition is concerned with the nature and properties of entire functional systems that include people and their environment (Engestrom 1996a).

Figure 19: The influence of structures and cultures on the processes involved in learning



This thesis extends this concept by demonstrating how persons acting in settings use a range of aids, which not only include tools and physical objects, but also their bodies. It was shown in Chapter Seven how use of the body enables the successful accomplishment of cognitive tasks, in conjunction with other persons and artefacts. This aspect is overlooked in distributed cognition literature (see Pea 1993; Salomon 1993; Shapiro 1994) which simply focuses on the (whole) individual in interaction with the environment. The findings presented in this Thesis support the notion of the themes gaining increasing salience in the computer-supported collaborative work (CSCW) literature (Cranny-Francis 1995; Robertson 1997; Varela, Thompson & Rosch 1991) of "embodied action". The nature of human-computer interaction is a goal of CSCW so that researchers and practitioners may develop better technological designs. These issues will be further discussed later in the Chapter.

Chapter Eight analysed the influence of contexts on processes of reflection. The findings discussed revealed how work that is temporally demanding requires, for example, delaying reflection and conceptualisation processes of learning, thus inhibiting opportunities for immediately learning at the console. Work organised such that it involves a complexity of decision making and tasks often makes the explication of rules and their application difficult and opaque, thus inhibiting both the formal learning of such tasks and the identification of strategies to enhance learning these kinds of activities. This finding presents further evidence of how the structuring of experience influences opportunities for reflection. Literature on reflective practice (e.g., Schon 1991) does not address the issue of whether reflection is influenced by time-delay, such as that experienced in ATC work, though evidence from information processing theories of learning (e.g., Weiten 1992) would support the contention that reflection would be inhibited under these circumstances. This is because intensity of information and its complexity would be likely to lead to interference of recall, thus inhibiting capacity for reflection (Postman 1971 in Weiten 1992). Part of the difficulty with workplace environments where individuals have to respond immediately to changes in those environments under periods of pressure and intensity is that often they do not encourage reflection in any systematic way.

There were, however, organisational structures that did enhance reflection in informal learning though this was not their primary purpose. These structures included practices such as those involved in differentiating and integrating work organisation (see Figure 19). From the data presented in Chapter Eight, it was concluded that work that was organised so that performance required different roles surrounding the same work activity (such as taking on the role of instructor) allowed the controller to view the work from a different vantage point. Informal learning for the controller performing the role of instructor was enhanced since the instructional role required observing and reflecting on the controlling job. Team-work was also found to be an important structure enabling reflection, provided certain conditions were met. These included a team-culture based on open communication patterns and norms of practice that involved sharing information and inquiry. This finding is supported in the team-work literature where structures of team-work were found to increase decision making effectiveness (Bantel & Jackson

1989) and that teams with better communication practices also achieved higher levels of performance (Merritt 1995).

This Thesis also showed how cultures, in some circumstances, support resistance to practices of reflection in cases where reflection was not part of a workplace group's typical behaviour, or where such behaviour is not congruent with individual and social identities (Augoustinos & Walker 1995). Styles of identity within the aviation industry are typically based on "can-do" forms of behaviour (Helmreich & Merritt 1998) and these typically do not openly value reflection. The problem of resistance to reflection is largely overlooked within the reflective practice literature (e.g., Schon 1991), though some research is being undertaken into this theme (James 1997). James (1997) found that workers enrolled in a vocational education and training course resisted the notion of reflection because it ran counter to their workplace identities as "doers" rather than "thinkers" and was thus not seen as having any value. The findings presented in this Thesis support the view that cultures create resistances to particular practices.

The data presented in Chapter Nine demonstrated that there was a link between work-group cultures and individual controller conceptualisations about work performance and learning. The data also revealed how cultures were based on the collectively held beliefs that "good" controlling was related to ability and performance, and this provided evidence of the influence cultures have on the reflection process. These collectively held beliefs were found to have an inhibiting effect on learning, since controllers ascribing to these views sometimes even lacked the motivation to look for strategies to assist learning in the ATC workplace. Norms of practice and communication were mediated by the kinds of conceptualisations controllers individually and collectively held about work performance. Where controllers had experiences that had resulted in "Lone Ranger" conceptualisations and worked within groups where norms of practice were not based on team-work, informal learning as part of everyday work practice was inhibited. This was supported also by individual or social identities that were embedded in behaviours that did not include practices of inquiry. However, other contextual features were found to enhance learning. The data examined showed how changes in cultures, for example, from working as "Lone Rangers" to "Team-players", provided positive results for both accredited and informal learning in the ATC workplace.

These findings support the literature on workplace culture and its role in mediating processes involved in thinking and reflecting (e.g., Argyris 1991, Levinthal & March 1993). Although making meaning from experience is an essential element of learning, it also can constrain learning when such collective beliefs become tacit assumptions whose relevance in a new situation is never questioned or tested (Argyris 1991). In this way the interpretation of experience through certain collective belief structures and value systems can limit reflective and conceptualising processes (Levinthal & March 1993) and lead to what Weick terms "socially organized forgetting" (Weick 1987). In this sense, expressions of attitudes, values and beliefs reproduce the status quo as they serve "not only to orient that individual to that particular social

object, but also to position that social object, as well as justify and reproduce, the social system which produced those social positions" (Augustinos & Walker 1995, p. 29). The findings presented in Chapter Nine support this view. The data showed how accredited learning was sometimes used to "weed out" those not conforming to dominant norms of practice or stereotypes, and because their performance did not meet with instructors' conceptualisations about what was required to be a good air traffic controller (namely, displaying ability and confidence through performance). Conceptualisations based on collectively held beliefs and values were shown also to influence informal learning, because they, in some cases, inhibited practices associated with inquiry.

Chapter Ten investigated how contexts enabled and constrained the process of experimentation. The physical organisation of the work obviously has a dominant effect on the degree to which experimentation is enabled or even desired, though other aspects of experience, reflection and conceptualisation were also implicated in readiness for experimentation, and mediated by contexts. For example, the findings presented in Chapters Five, Seven and Nine show that being able to project confidence is a necessary part of the practice of ATC work and this represents the importance of the affective component of experience in this workplace. Affect was found to have a significant influence on both performance and learning in ATC, since those without confidence were less likely to reveal what they did not know and engage in inquiry-related behaviours and were also less likely to experiment and try out new ways of working, thereby inhibiting their own possibilities for learning and the learning of others (see Chapters Nine and Ten). This is supported in the literature on psychological learning theory, where a positive self-concept is linked to the degree of openness in communication and the amount of risk-taking (both in actions and in self-disclosure) that an individual will engage in (Bandura 1997; Markus & Kitayama 1991).

Although the adult learning literature focuses on the role of affect on learning involved in both on- and off-the-job accredited learning (e.g. Boud & Walker 1996), this Thesis expands this view by extending the investigation of the role of affect to informal learning in the workplace. Affect is present in feelings of self-efficacy (Bandura 1997) and the findings presented in this Thesis support the role of self-efficacy in learning. Self-efficacy beliefs concern one's ability to perform a particular task or role (Bandura 1997). The stronger one's self-efficacy, the more an individual will exert effort and persist at that task. Fiske and Taylor (1991) on reviewing the research on self-efficacy, conclude that when faced with a challenging task the individual who believes he or she has the capabilities to perform the task effectively will be more likely to undertake it and persist at the task than the individual who has doubts about their ability to perform the task successfully. This Thesis supports this perspective by showing how affect, when present as confidence, and thus self-efficacy, influences performance in important ways which includes capacity for experimentation.

The findings also showed how cultures of practice that operated in team-work contexts enhanced inquiry-related behaviours because individuals felt more comfortable with team-members and in certain conditions could develop trust and understanding through continuity of experience. This increased the capacity for a controller to seek out the experiences of another or to ask for input to increase the possibilities for action. Under these conditions the processes of experimentation were enhanced since the individual could increase the number of potential options available for solving a particular problem by sharing and seeking past and present experiences of team-members thereby enhancing the diversity of options available to choose from.

Chapter Eleven addressed the third research question: "In what ways do organisational changes, such as the introduction of complex technology, influence workplace learning?" It demonstrated how organisational change processes of recent years have fundamentally changed the ways in which people learn about the complex organisations and systems within which they work, with both positive and negative results for learning. Changes over time revealed how the "breadth" of work experience has narrowed as a result of the removal of a range of work activities with the consequence that there are now reduced the opportunities to informally learn about the aviation system. These shifts occur at a time when structural changes in traditional ways of recruiting controllers have led to a change in the gradient of the learning curve imposed on new recruits (i.e., one that is much steeper than has been so in the past) because those recruits have not had available to them the background of aviation experience many of their predecessors had. These changes increase the need to look for ways of spanning boundaries within and between organisations and functions to compensate in two ways: first as compensation for the deficit of background knowledge and second because of the increased importance of system understanding required of complex, information-based environments (ICAO 1994; Maurino et al. 1995).

Structural changes have also led to changes in cultures with negative aspects for informal learning. The findings revealed how, in terms of cultures, story telling is a fundamentally important component of learning in complex organisations, but that access to this form of learning has diminished due to the narrowing and splintering of functions, and this has resulted in reduced capacities to learn from them. The important role story-telling could play in typical workplace learning programs has been overlooked (e.g. Blunden 1997; Burns 1995; Merriam & Caffarella 1991; Orlich 1990; Tovey 1997); however, its value has been recognised by some theorists and practitioners (Beattie & Conle 1996; Kaye 1996; Weick 1987). Story-telling as a means of informal learning deserves greater attention in workplace learning programs.

The findings synthesised above have implications for the creation of educative work environments and these will now be discussed.

12.3 Implications of findings for the creation of educative workplaces

The outline above has summarised the main findings presented in Chapters Five to Eleven. What are the implications for practitioners interested in enhancing the possibilities of continuous learning and thus the development of educative work environments? Although these findings are based on a phenomenological study of one (High-3) workplace, and thus their generalisability is constrained, it is contended that these findings could plausibly relate to other workplaces and their relevance could thus be tested. In Chapter Six it was claimed that the purpose of presenting the findings using the framework outlined was to provide a bridge between learning and organisation theory. In this section, the implications of the findings will be discussed from these two perspectives in order to build this bridge. The findings will be discussed first from the perspective of learning; and second, from the perspective of organisational development. In so doing, the discussion identifies strategies that can be used by practitioners of learning interested in better understanding how organisational contexts influence workplace learning. In the second part, discussion reveals how practitioners of organisational theory can evaluate workplace design in terms of its impacts on possibilities for learning. Both perspectives on learning in the workplace are needed if the goals of continuous learning and the development of educative work environments are to be achieved.

12.3.1 The role of context in workplace learning

The purpose of this section is to outline for facilitators of workplace learning how environmental contexts influence engagement in learning activities. Workplace learning facilitators are likely to be those persons charged with enhancing learning in the workplace and who work with both trainees and with workplace instructors to improve their skills. For the most part, this section will discuss the implications from the findings for learning in accredited formal workplace learning. Having commenced with an overview of how contexts influence accredited workplace learning, the discussion will then be organised around each of the four processes identified as important in learning: experience, reflection, conceptualisation and experimentation.

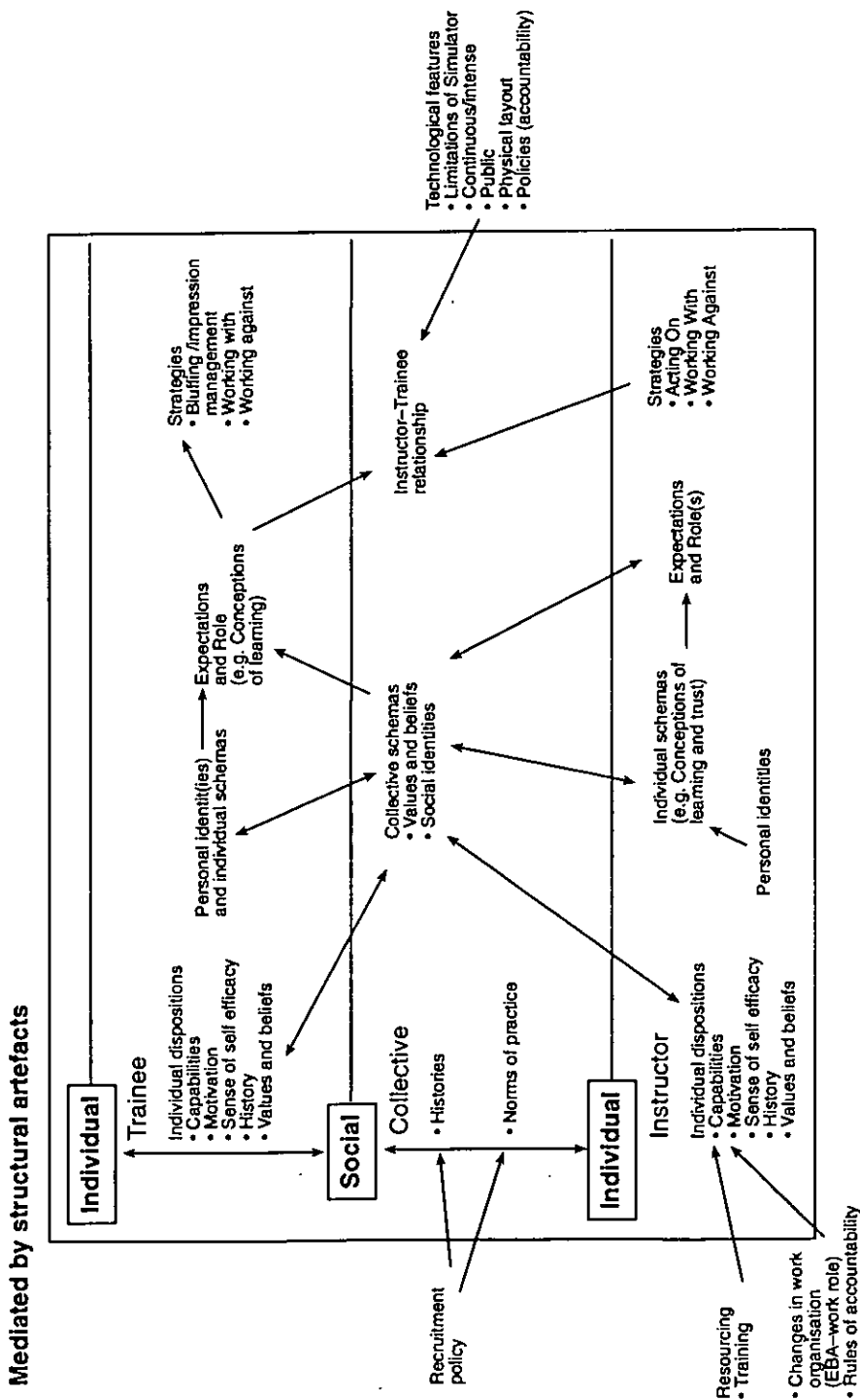
12.3.1.1 The contextual mediation of accredited workplace learning

Figure 20 illustrates the ways in which accredited on-the-job learning is mediated by structural and cultural contexts. The Figure shows how the one-to-one training that occurs in most workplace learning programs is a collaborative activity between instructor and trainee. It is contended that the individual dispositions (see Figure 20) of both instructor and trainee are influenced by structural artefacts such as recruitment policy and resources available for training. These set up various histories of experience that are held collectively.

The personal values and beliefs of both trainee and instructor are influenced by cultures based on histories of experience and their interaction with collectively held values and beliefs. Individual schemas and personal identities are developed based on these attributes (Augoustinos

& Walker 1995) and these influence — and are influenced by — collectively held beliefs that are included within collective schemas (see Figure 20). In the findings it was shown that structural and cultural features influence the instructor-trainee relationship through formal and informal establishment of expectations and roles that each brings to the accredited learning activity (see Chapter Nine). This is supported by learning literature (see for example Heimlich & Norland 1994; Merriam & Cafarella 1991; Schwarz 1994) and by research examining the impact of workplace culture on performance (e.g., Helmreich & Merritt 1998). The strategies employed within accredited learning of, for example, “Acting On”, “Working With” or “Working Against” (on the part of the instructor); or engaging in impression management or collaborating with the instructor (on the part of the trainee) are mediated by the cultural context of the workplace.

Figure 20: The contextual mediation of accredited ATC learning



Within the activity of accredited learning, structures and cultures continue to influence the opportunities for turning experience into learning through reflection, conceptualisation and experimentation. What are the implications for workplace facilitators? The following Table sets out some of the implications based on these findings.

Table 21: Influence of context on workplace learning

PROCESSES OF LEARNING	SALIENT FEATURES	IMPLICATIONS
Experience	Temporal Complex Affective Social	Importance of ensuring good depth of both job content knowledge and instructor content knowledge
Reflection	Delayed Fuzzy/Opaque Tacit	Importance of using strategies to capture experience for rich reflection and in enhancing opportunities for reflection
Conceptualisation	Schemas	Importance of using cognitive-mediational strategies to investigate roles of individual and collective schemas in learning
Experimentation	Private/public Incidental/ intentional	Importance of creating environments to enhance shared and intentional experimentation and to support appropriate emerging communities of practice

Within the activity of accredited learning, structures and cultures continue to influence the opportunities for turning experience into learning through reflection, conceptualisation and experimentation. What are the implications for workplace facilitators? The following Table sets out some of the implications based on these findings.

Table 21 summarises the salient features of each of the four processes of learning and outlines some of the findings for facilitators of workplace learning. The implications of these findings will now be discussed.

12.3.1.2 The contextual mediation of workplace experience

In work environments that are temporally and complexly demanding, that involve considerable psychological investment, and that occur with a high degree of sociality, a common way of building up a depth of understanding of the job occurs through direct experience, as discussed in Chapters Seven and Ten. In the findings presented in this Thesis, job content knowledge in ATC is built up through experience over a considerable number of shifts as controllers build up a reservoir of handling both routine and non-routine problems (Suchman 1996). A depth of job content knowledge is clearly important in undertaking work, particularly work that occurs in

High-3 environments, and is consistent with research on expertise (Chi, et al. 1988). In terms of accredited learning, having access to knowledgeable others with sufficient depth of job content knowledge is an important requirement for successful outcomes (Biggs & Moore 1994). Expert workplace instructors have elaborate ways of understanding content knowledge; similarly instructors with a depth of pedagogical knowledge have developed a variety of strategies for assisting and assessing trainee learning. In many professions, learning content knowledge relevant to the job comes with time or experience in the job together with participation in professional development programs and, as has been discussed in Chapter Ten, this is also the case in the ATC workplace.

However, what is often overlooked in the literature (e.g., Berryman 1993; Biggs & Moore 1994), and what has been identified in this Thesis in Chapter Eleven, is the ways in which opportunities to gain depth of content knowledge are changing. Much of the literature assumes a stable, reasonably unchanging environment in which individuals gain their expertise (Berryman 1993; Chi et al. 1988). As the findings of this Thesis reveal, organisational change processes can have a disruptive effect on opportunities to build up content knowledge, especially in workplaces where acquisition of content knowledge occurs primarily through experience in the workplace. Chapter Eleven showed how a number of changes are reducing the capacity for controllers to build up their content knowledge through experience in many important ways. How individuals gain depth of content knowledge in changing environments has particular implications for facilitators of workplace learning and needs to be addressed. A depth of content knowledge is important because it provides the foundation for knowledge that is used and shared in both accredited and informal learning. Facilitators of workplace learning, then, need to ensure that workplace instructors have opportunities to build up a good depth of job content knowledge and, if not obtainable directly, that they can acquire it by other means.

Such knowledge could be obtained through a range of strategies aimed at supplementing direct experience, which include field trips, development of training programs aimed at conveying relevant information, talking with others who have greater experience or through simulation. However, the use of all of these strategies would need to be evaluated in terms of the contextual features of the job. For example, although simulation would appear to be an attractive means of substituting for direct experience, and does provide a valuable means of gaining specific skills, the simulator is not a complete substitute for the development of workplace experience, for two reasons. First, in ATC work, the technology available cannot provide a sufficiently authentic representation of the work practice as that practice occurs in concert with everyone else (i.e., the sociality of experience in the way controllers work in with other controllers and pilots in negotiating routine and non-routine trouble). That is, it is useful to develop specific controlling skills, but it cannot simulate the nature of the interdependence of the work activity. Second, the demands for training fully occupy the simulation equipment that is available and this demand increases as the major Centres centralise work activity and take on a greater number of sectors as part of work consolidation. Thus, while particular strategies such as the use of simulation are an

important means of gaining specific aspects of experience, they cannot be relied upon in isolation.

The need for workplace facilitators to attend to the means by which individuals build up their job content knowledge is also important because of the increasing emphasis that now needs to be given to boundary issues (Anand, Manz & Glick 1998; Guzzo & Dickson 1996) as a result of increasingly uncertain and complex environments (see Chapter Eleven). The findings presented suggest that there is a greater imperative for the workforce to understand the implications of their job in relation to the wider organisation and system that the work activity is part of. It is argued that this will be of particular importance in work organisations in the future, especially those involving knowledge work that is embedded within interdependent structures using tightly-coupled, complex and/or automated technologies (ICAO 1994; Maurino et al. 1995; Zuboff 1988). Developing sufficient depth of content knowledge, as it relates to understanding the internal and external boundaries of the job, thus becomes an important feature for future workplace learning.

As discussed, depth of job content knowledge may not be available because of the lack of experience of team-members or because of a lack of opportunities to learn about the inter-relationships between various components of a work system. This raises the question of how, under these circumstances, a workplace learning facilitator would aim to increase the requisite variety available to trainees engaging in on-the-job-learning. One means of facilitating the access to job content knowledge for trainees in changing environments is to make the process of facilitating trainee accredited learning the responsibility of the whole team, so that the depth of experience available within the team can be used as a resource. There are a range of ways in which this could be achieved that are not limited to simply sharing the instructional duties around within the team. In appropriate team cultures (one where inquiry-related behaviours are a norm of practice), team meetings could set aside time for trainees to share their experiences to date and to seek input from other members. Such communicative practices could benefit the whole team because they may also provide new insights for team members, thus enhancing collective memory, or drawing attention to divergent practices that may need to be discussed and addressed. Ensuring that teams comprised members with a range of background experiences also would enhance the job content knowledge that would be available in the team.

Just as accredited learning relies on knowledgeable others in terms of job content knowledge, pedagogical knowledge also has been identified as an important pre-condition for success (Berliner & Calfee 1996; Shulman 1987, 1990). Pedagogical knowledge is here used to refer to understanding about how learning occurs and how it can be enhanced and assessed. At present in ATC, to become instructors, controllers undertake a four-day on-the-job-instructor training (OJIT) course. The kind of pedagogical understanding that can be developed in a four-day period of training obviously is limited. As discussed in Chapter Four, in terms of formal learning, the level of resources available to enhance instructor development has a direct influence on the

collective development of skill (ATC Review 1992). The level of learning enabled by instructing others will only be as good as the level of resources provided to staff to develop their instructional expertise. Although there has been a desire within the organisation to provide more financial resources to enable more skills development for individuals, this has not been forthcoming. However, based on the findings presented in this Thesis, the kind of program offered may also need to change. The findings showed how instructors adopted or rejected aspects of information presented on the OJTI course depending on their conceptualisations of ATC work. These conceptualisations were in turn mediated by cultures. Much of the literature on workplace learning has overlooked the ways in which individual conceptualisations and cultures mediate workplace learning programs, including instructor training (e.g., Blunden 1997; Burns 1995; Merriam & Cafarella 1991; Tovey 1997), and this area needs greater attention. It is contended that because of the influence of cultures on instructor conceptualisations of learning, the kind of training program aimed at enhancing instructor skill also needs to be modified from one based on a receptive-accrual form of information transmission to a cognitive-mediational one (Putnam & Borko 1997). This will be further discussed below with the role of conceptualisation. One aspect that will be important in enabling instructional development will be the encouragement of reflective practice for both instructors and their trainees (James 1997).

12.3.1.3 The contextual mediation of reflection

In terms of enhancing accredited workplace learning, facilitators need to ensure a variety of means of capturing experience so that it can be reflected upon later. The findings presented in Chapter Eight revealed that in High-3 work environments, work experience is often intense and any reflection is delayed, and this also leads to reflection that is often fuzzy and opaque. Utilisation of audio-and video-recordings provide a valuable means of re-visiting workplace experience and these strategies can be used by trainees and for instructor development (McLennan 1996; Engestrom 1995). Appropriate work-spaces where instructors and trainees can sit and talk are also necessary.

Encouraging reflection as part of work activity has been a feature of many professional development programs (see for example Schon 1991) and pre-service courses (e.g., Appleton 1996) though, as has been discussed, some work cultures may resist engagement in reflective practice because such activity is neither part of their history of experience nor part of their collective identity. Within these kinds of workplaces, structuring work practice such that reflection is built into the accredited learning process may be necessary. Instructors and trainees, for example, could be expected to commence and end the working day with 30 minutes feedback time away from the console, (although it is acknowledged that this would put added pressure on other team-members to cover this time on the console). Enhanced reflection would also be enabled by improved instructor content knowledge as instructors learned the means of facilitating reflection through, for example, appropriate questioning. The ways in which workplace facilitators are encouraged to develop reflective practices in workplace instructors will be discussed in the next section.

12.3.1.4 The contextual mediation of conceptualisation

The findings presented in Chapter Nine and throughout this Thesis provide strong support for the learning theory of social cognition and constructivism (Resnick 1993; Putnam & Borko 1997). As discussed above, most accredited learning programs are based on a receptive-accrual model of learning in that learning is assumed to take place through receiving information and skills and understandings are accrued based on this transmission.

The notion of constructivism suggests that all experience and learning is filtered by what the individual currently understands and believes. Constructivism has two forms: cognitive constructivism, which focuses on an individual's internal schemas and mental models for making sense of the world; and social constructivism, which emphasises the role of the social context in shaping what is learned (Appleton 1996). Therefore, an individual's current belief systems are going to influence what that person accepts and learns. Theories of constructivism challenge the notion of learning through reception and accrual because individual and cultural beliefs will enable and constrain what is observed, noticed and thus received (Resnick 1993). The findings presented in Chapter Nine demonstrated that the current knowledge and belief systems of the controller serve as critical filters influencing and determining what controllers will accept and learn.

A cognitive-mediational approach to facilitating workplace learning would focus on the existing knowledge and beliefs of participants as they learn and provide opportunities to challenge and confront those belief systems when necessary. The role of the workplace facilitator in this model would be one of mediator of meaningful participant learning. Such facilitators would need to be able to know how to create environments that foster learning for understanding and self-regulation, as well as focusing on methods of assessment that reveal student's thinking (Beattie 1997). An example presented by Putnam & Borko (1997) of a cognitive-mediational program encouraged teachers involved in professional development to interview someone who is likely to challenge their beliefs. One option for consideration includes having instructors examine their reasoning with other controllers who hold opposing belief systems. Change can also be encouraged through getting instructors to examine their practical arguments. A practical argument describes a person's reasoning about actions by specifying the rationales, empirical support, and situational contexts that serve as premises for the actions (Putnam & Borko 1997). The assumptions behind such a program are that when instructors examine their beliefs with a valued other (e.g., a controller who is well regarded), then there is a critical examination of those beliefs that is likely to lead to a change in thinking, or at least a questioning of previous assumptions. Such introspection is less likely if the information is transmitted via an information-accrual model, particularly if conveyed by someone external to the controller's culture.

While beliefs are important in learning, thinking and knowing, a cognitive-mediational approach needs to be seen as a complementary approach, together with receptive-accrual modes of information delivery. In the workplace studied, ATC instructors need to be encouraged to examine critically their knowledge and beliefs about trainees and their learning. Instructors also need support as they learn new instructional approaches and change their existing understandings. Supporting emerging communities of practice as they experiment and try out new ideas in High-3 work environments will be discussed in the next section.

12.3.1.5 The contextual mediation of experimentation

The findings presented in Chapters Nine and Ten showed how current ways of working and trying of new practices are mediated by existing cultures. These findings support theories of social cognition and constructivism, where what is regarded as “good” practice is determined by collectively held values, beliefs and norms found within the broader work culture (Helmreich & Merritt 1998; McInerney & McInerney 1994). If new strategies are found to challenge existing conceptualisations, as discussed above, then participants need to be given opportunities and encouragement to experiment with those changed practices in intentional ways and be given support until those practices become the norm. One means of doing this is to provide role models who display the kinds of thinking and practice that support goals of continuous learning, enabling participants to engage in private experimentation as they observe and learn vicariously (see Chapter Ten).

Chapter Ten also showed how opportunities for experimentation are mediated by the structuring of work experience as well as cultures and concluded that strategies needed to be found to enhance intentional and shared experimentation, and that this is important in both accredited and informal learning. Intentional forms of experimentation can be shared by creating emergent communities of practice that are supported as individuals and groups begin to learn new ways of acting and to develop new belief systems that accompany changed practice. Emergent communities of practice (Hendry 1996) can be supported by workplace facilitators through follow-up sessions after accredited learning programs and these may be face to face or utilise other means of group discussion, such as electronic mail. What the experiential theory of Kolb (1984) points to in this context is the importance of creating environments where individuals can experiment in intentional ways and where those ways can be shared. Other strategies associated with shared and intentional experimentation will be discussed under the section discussing the implications for organisational developers later in the Chapter.

12.3.1.6 Summary

The section has discussed the implications of the findings presented in the Thesis for facilitators of workplace learning. It has outlined a range of strategies facilitators could use to enhance the effectiveness of workplace learning. Most of the examples used related to accredited learning settings. The next section will draw on the findings to discuss their implications for organisational development and the focus here will be on informal learning.

12.3.2 The mediation of learning in organisational design

The impacts of organisational design on individual and group behaviour have been studied over a long period (e.g., Tosi et al. 1995; Jones 1995). What has been largely overlooked, however, is the influence organisational design has on learning within everyday work practice, though this has recently been given attention, albeit implicitly, within human factors research and that associated with computer supported collaborative work (CSCW) (Engestrom & Middleton 1996b). This is described as “implicitly” because although learning is fundamental to the goals of human factors and CSCW, it is rarely identified as such (Owen 1998; Lave 1996). The purpose of this section is to consider the ways in which practitioners of organisational development create environments that enhance learning within everyday work practice. Practitioners may include those interested in human resource development, human factors, computer-supported collaborative work and organisational studies. It should be noted, however, that the features discussed here were found to be salient within one workplace which had a highly bureaucratised organisational structure. This form of work organisation may not have much to inform organisations with very different structures.

As discussed throughout the Thesis, organisations comprise structures involving formalisation, differentiation and integration as well as cultures that are manifested in collectively held beliefs values and norms of practice, shared language, and histories of experiences shared through stories and other forms of narrative. It has been argued that these aspects of organisation are critical to understanding how learning in the workplace is enabled and constrained. The implications for each of these aspects of organisation will be discussed: formalisation, differentiation, integration and culture.

The ATC workplace was found to have particular combinations of structures and cultures, though it is argued that the examples presented in the data can be found in many other organisations, particularly those associated with High-3 work. In this section some of the structural and cultural features that have been highlighted in this Thesis will be reviewed to evaluate what they imply for informal learning within work practice, and thus to identify what features of organisational development would need to be supported in order to create educative work environments and thus opportunities for continuous learning.

12.3.2.1 Structures of formalisation

A summary of the potential effects of structures on learning, of formalisation, based on analysis and extrapolation from the findings, is provided in Table 22. This Table summarises the impacts of a high or low level of formalisation on opportunities for each of the processes important in learning: experience, reflection, conceptualisation and experimentation.

The degree of formalisation of work procedures refers to one aspect of the division of labour within an organisation. Formalisation in this Thesis was defined as the degree of rigidity applied

to ensuring compliance to certain rules and procedures (Tosi et al. 1995). For example, a high degree of formalisation would lead to experiences with less job variety (in terms of deciding how the job could be undertaken) and as a result, low levels of autonomy; whereas a low level of formalisation would result in experiences of increased autonomy (see Table 22). Opportunities for reflection and conceptualisation will be influenced by the degree to which these processes are formally embedded within procedures. Engagement in these processes could, of course, occur without such formalisation. However, it is contended that changes through systematising and sharing insights gained from reflection and conceptualisation on work practice will be enhanced

Table 22: Influence of structural elements on opportunities for informal learning: Formalisation

STRUCTURAL ELEMENT	EXPERIENCE	REFLECTION	CONCEPTUALISATION	EXPERIMENTATION
Formalisation High	Tightly coupled Less variety through low autonomy	Can be included in procedures that formalise work activity in terms of opportunities for reflection	can include enhanced capacities for conceptualisation if built into procedures	↑* collective capacity for quick uptake ↓* experimentation
Low	Increased autonomy			↑* experimentation ↓* independent action ↓* transfer across organisation

* : ↑ = increase in; ↓ = decline in

if such processes are embedded within work activity and organisational systems. Having sets of procedures and rules (that are strictly adhered to) limits opportunities for independent and incidental experimentation and thus attenuates one means of obtaining innovation. A work organisation that is highly formalised enables the transmission of the change to be quickly adopted by the rest of the workforce.

Less formalised procedures increase independent action and capacity for experimentation, though transfer of insights gained from such action would be slower than if processes of experimentation, like reflection and conceptualisation, are formalised within organisation structures. In work involving continually changing conditions and higher order thinking,

routinisation found in highly formalised procedures can only occur to a certain extent and there will always be situations that cannot be anticipated or formalised into ordered ways of working. In these cases there is often a reliance on culture (Bierly & Spender 1995; Helmreich & Merritt 1998; Klein et al. 1995) to ensure compliance and standardisation of ways of working.

Formalisation also can be one means by which the organisation builds in feedback loops for learning at group and organisational levels. This occurs when reflective, conceptualising, and experimenting processes are built into procedures. Integrating reflection, conceptualisation and experimentation into work protocols has been the focus of much of the human factors research (Reason 1998; Westrum 1997, 1998a). Such procedures need to be part of the organisation's integrative mechanisms if learning is to benefit from any feedback gained through such procedures and this will be discussed in the next section.

12.3.2.2 Structures of differentiation and integration

Structural differentiation, according to Tosi et al. (1995) is the process of unbundling sub-system activities separating a specific set of activities from others. Structural integration occurs when efforts are made to coordinate the various activities that are created by structural differentiation. This links the differentiated sub-units back together through authority, responsibility and accountability relationships (Tosi et al. 1995). The major features of structures of differentiation and integration and their implications for processes of learning are summarised in Table 23. Table 23 summarises degrees of differentiation and integration that can occur within an organisational structure. It also outlines the influences these kinds of organisational structures have on opportunities for the four processes of learning.

Table 23: Influence of structural elements on opportunities for informal learning: Differentiation and integration

STRUCTURAL ELEMENT	EXPERIENCE	REFLECTION	CONCEPTUALISATION	EXPERIMENT- ATION
Differentiation High	↓* variety ↑* continuity	determined by the nature of the work activity	variety of tasks: multiples may facilitate greater understanding of system	Narrowly defined
Low	↑* variety ↓* continuity			Greater opportunity
Integration (e.g., team-work)	↑* collective continuity across group ↑* variety of experience available	Sharing of reflections and conceptualisation possible if members comfortable and open to new ideas		↑* pool of experiences to draw on, leads to more strategies

*: ↑ = increase in; ↓ decrease in.

When work is highly differentiated, it is specialised. If structures of work organisation are highly differentiated and jobs are very specialised it will provide opportunities for individuals to learn a lot about one specific area of focus. However, highly differentiated and specialised work will involve less variety (see Table 23). This enables individuals to build up a depth or continuity of experience that can be brought to bear on a particular, specific problem, and historically this was the case in ATC (see Chapter Eight). In Chapter Five it was found that in ATC work there had been a reduction in the specialisation of work tasks through policies of multi-tasking. If a job is not specialised but contains multiple roles and/or tasks, it will enable individuals to engage in multiple experiences and, hence, to have greater variety in work activity (see Table 23) and, therefore, greater opportunities for learning through a variety of experiences. However, as was found in this Thesis, a decrease in the level of differentiation can result in increased variety and a decline in the continuity of time employed on a particular task (see Table 23). If the work involves substantial variety in terms of tasks and roles, there is a danger that the continuity of experience may be lost as a result of being involved in a variety of tasks and what may occur is a superficial level of experience leading to limited learning or a “diluted experience” in any one activity (see Chapter Ten).

It has been argued in this Thesis that being involved in a variety of tasks (high differentiation) may facilitate greater understanding of the work system because individuals will have been

involved in different work activity and will have had contact with different actors involved in the work system. This variety of workplace experience can aid conceptualisation when thinking about how various job roles inter-relate. The findings in this Thesis add to this conclusion by showing how level of background experience is a key factor in enabling a continuity of informal learning.

Structures that support high differentiation may lead to specialist activity and structures that support low differentiation may lead to generalist work activity. In a work organisation where there are many people engaged in similar work activity, there will be opportunities for people to converse with one another and thereby to collectively pool experience. It is argued that the kind of work activity (whether specialist or generalist) needs to be considered by organisational developers in terms of the degree to which the nature of the work experience provides opportunities for the development of deep or superficial understandings of work activity as well as for opportunities to move into other processes of learning (i.e., reflection, conceptualisation and experimentation). This kind of evaluation is largely overlooked within the organisational development literature (i.e., Tosi et al. 1995; Jones 1995) considering the nature of work activity and the degree to which work performed provides opportunities for processes of informal learning.

12.3.2.3 Structures of integration and their influence on informal learning

Structures of integration are aimed at coordinating differentiated activities (Jones 1995). It is contended that the ways in which informal learning occurs within an organisation will be determined, in part, by the type of "integrative mechanisms and lateral linkages" (Thompson & McHugh 1990, p. 84) built into organisational structures. The distribution of knowledge occurs when feedback loops, for example, are integrated into work activity within and between work groups and divisions. Human factors-related programs such as crew resource management and team-building (e.g., Weiner et al. 1993) are aimed at enhancing the knowledge that is shared within groups because they increase the level of integration within groups. It has been argued in Chapter One that in contemporary organisations work is likely to be based on knowledge, be service driven and computer-mediated, or involve a combination of these activities (Jones 1997). In these work organisations, what is important is the capacity of groups to learn from the experiences of others. The capacity for individuals to move between work groups of different functions will also be important in learning terms because it enables individuals to bring a diversity of perspectives to a particular work activity through having had differing experiences and, therefore, bringing different reflections and understandings to bear on the task at hand and because it generates systems (or environmental) understanding (Anand et al. 1998; ICAO 1994; Westrum 1993).

There are a range of factors which assist in integrating activities and all have implications for informal learning. The size of work groups has been identified in other research as influencing opportunities for collectively pooling experience (Guzzo & Dickson 1996; Beyerlein et al. 1997).

This is because group size is one factor which influences the degree of homogeneity and diversity within the work group thereby influencing opportunities for learning from different experiences and histories and consequent differences in perspectives based on reflection and conceptualisation. These differences are likely to lead to greater diversity in possible action. The sharing of different experiences through reflection and conceptualisation and the generation of possible actions will only be possible, however, if members feel comfortable to communicate these experiences and ideas or can make themselves heard.

An integrative structure such as team-work, for example, enhances the range of experiences available within the team by increasing the continuity and variety of experiences available within the group. Being involved in team-work is likely to lead to increased familiarity and thus increased communication (Guzzo & Dickson 1996), though, as the findings in this Thesis attest, the possibility of creating communication-oriented team-work depends on individual and collectively shared schemas that govern roles and expectations. Where larger groups have the possibility of benefiting from diversity, smaller sized groups, on the other hand, are likely to have greater opportunities for participants to build up familiarity and trust (Guzzo & Dickson 1996). The findings presented in this Thesis showed how these conditions underpin learning because they enhance openness in communication.

Greater attention, however, needs to be given to how information is shared between groups within the organisation, and with groups external to the organisation (Tompkins 1997). Boundary spanning is, therefore, one means by which the organisation connects itself with the environment (Tosi et al. 1995). It was shown in Chapter Eleven that, historically, the boundaries between the internal and external environment in ATC have been more permeable than is the case at present. However, as has been argued, there is a need for individuals to have a good understanding of their work roles in relation to those boundaries. This, it was argued in Chapter Eleven, will be more important in environments requiring what has been defined in this Thesis as intellectual interdependence.

12.3.2.4 The mediation of work experience by physical work organisation

One of the key roles of this Thesis has been to map out the ways in which the physical organisation of work influences experience by structuring it in certain ways. It has done so by identifying the dimensions of temporality, complexity, affectivity and sociality as being salient within the workplace studied. These findings support the field of practice associated with computer-supported collaborative work (CSCW) (Bentley et al. 1992; Heath & Luff 1991). CSCW investigates the ways in which technologies structure work and communication with others. Such research demonstrates how the social organisation of work occurs in the interactions between workers and their work practices involving technologies-in-use (Heath & Luff 1991). For example, Hughes et al. (1992) found that ATC work "is not encountered as a set of discrete tasks involving chunks of data and distinct procedures, but rather as a *free flowing gestalt contexture*, with activities overlapping, and moving through foreground and background in

response to (and constituting) the situation as it develops.” (p. 117, emphasis in original). This work showed how the sociality of such work provided its “trustability”. This Thesis extends CSCW investigation in two ways: by investigating the link between the structuring of work activity and the affective dimension of experience (see earlier discussion this Chapter) and by extending analysis of the social organisation of work to structures other than technologies, namely policies and integrative mechanisms such as team-work.

Organisational developers and designers can investigate the ways in which the physical structuring of work activity bends and shapes the experiences people have and their opportunities for engaging in, and transitioning to, the other processes involved in learning. Work that is temporally and complexly demanding will offer different kinds of experiences and learning opportunities compared to work that is not. Work that involves more risk in public activity with others will engage individuals in affectively different ways compared to work that does not. Work that requires high degrees of inter-connectedness with others will shape experiences differently than work where interdependence is not a feature. Investigating the structural features of the workplace for the degree to which such arrangements enable or constrain processes of reflection, conceptualisation and experimentation would seem to provide a valuable tool for organisational developers interested in creating educative environments.

12.3.3 Cultures

The data analyses in this Thesis examined the ways in which values and beliefs filter action. This, it is contended, provides important insights for anyone interested in creating educative work environments. The findings presented in this Thesis support the view (e.g., Jones 1995; Hendry 1996) that cultures considerably influence organisational behaviour. High-3 organisations require a ‘culture of conscious inquiry’, which means the ability to express ideas, knowledge, and concerns about organisational practices that will not result in punishment but will instead result in efficient information flow throughout the organisation (Westrum 1993). Organisational designers (and workplace facilitators) could use the elements identified in the conceptual framework to conduct their own investigations of the cultures present within their workplaces to evaluate the degree to which they enable or constrain the various processes of learning. Paying attention to the informal language used in a work place reveals how individuals and groups make sense of their experiences. Work groups also could be encouraged to identify for themselves the ways in which these cultural elements are present in thinking about the job and how it is learning.

Cultures assist individuals and groups to make meaning of experience (Wheelan 1994). The way individuals and groups make sense of their situations and their consequent strategies for action are bound up in “complexes of values” (Augoustinos & Walker 1995) developed in relation to social or interpersonal situations. These cultural elements all provide insights into how individuals and groups shape and interpret their experience and how those individuals and groups learn (Jacobson 1996). These findings support the literature (Klein et al. 1995; Helmreich

& Merritt 1998; Merritt & Helmreich 1996; Reason 1998; Westrum 1993) which claims that workplace cultures play an important role in enhancing an organisation's reliability and its capacity to learn from mistakes by enhancing group understanding of shared meanings.

12.3.4 Summary

This section has considered the implications of the findings for those involved in organisational development and design. It has discussed the ways in which structures and cultures mediate opportunities for experience, reflection, conceptualisation and experimentation within everyday work practice. An educative work environment would be one where structures and cultures are evaluated for the ways in which they bend and shape each of the processes of learning, together with the ways they block or encourage the transition from one process to the next.

12.4 Conclusion

This Thesis has addressed the question: In what ways do organisational structures and cultures enable and constrain learning in the workplace? The basic premise of the Thesis is that the lived experiences of people at work are significantly influenced by their contexts (most commonly conceptualised in organisations as structures and cultures) and that these contexts are in turn reproduced or transformed by people. One of the main aims of this Thesis was to understand how these the processes interact so that we may create educative work environments in workplace organisations.

This study has shed light on the nature of structural reform occurring within Australia and its impact on everyday working life. As such, it has provided insights into a range of changes that are occurring within the nature of work and work organisation that, it is argued, are applicable not just to Australian workplaces but are relevant worldwide. Methodologically, the study has analysed the linkages between micro-levels of social interaction and the macro-levels of national and organisational change. In doing so it has addressed a gap in the organisational research literature (Engestrom & Middleton 1996b) by analysing issues of lived experience and interaction within everyday work practice in organisations undergoing transition and change.

In attempting to account for workplace learning, the Thesis drew on a range of concepts from learning theory (e.g., Bandura 1997; Benner et al. 1996; Berliner & Calfee 1996; Biggs & Moore 1994; Chi et al. 1988; Engestrom 1995; Lave 1996; Martin & Scribner 1991; Putnam & Borko 1997; Shulman 1990) and in so doing showed psychological learning theory could inform (and be informed by) situated understandings found within sociocultural learning perspectives. Two broad strategies have been relied upon to develop an account of the ways in which organisational contexts influence workplace learning and to evaluate the ways in which these contexts are changing. The first was a methodological one, which was to combine a qualitative emergent research design (Denzin & Lincoln 1994) - that enabled the close-up features of everyday interaction to be studied - with a more deductive approach aimed at investigating the forms of

context that were salient within the workplace under study. The second strategy was to develop a theoretical framework that enabled the evaluation of the ways in which these contexts influenced specific aspects of the process of learning. Defining the activity of learning in process terms enabled the inclusion of data from accredited formal learning programs together with evidence of informal learning embedded within work activity.

Together these strategies provided an account of how workplace learning is enabled and constrained by contexts and this then made possible the identification of elements that would need to be attended to if workplaces were to become educative sites where learning was a continuous process embedded within workplace activity. The framework used for analysis and the findings presented formalise the results of the study in a way that begins to bridge the gap between the organisation of work environments and the learning that enables work activity to be achieved successfully. It enables the articulation of strategies to support the work of practitioners endeavouring to create work environments that are educative. In summary, the contributions of the Thesis are:

- a descriptive analysis of the influence of structures and cultures on learning in the workplace;
- an application of a conceptual framework from learning and organisational theory;
- a framework integrating individual learning processes with the broader organisational context; and
- a model designed as a bridging structure between the application of learning processes within workplaces to the design of organisations as educative work environments.

The Thesis potentially enables workplace facilitators and organisation developers to distill the ideas contained in the Thesis and to look for evidence of the structures and cultures and its influence of learning in their own workplaces. From the research, a number of possibilities for future research emerge and these will be discussed in the next section.

12.4.1 Implications for future research

There are a number of implications for future research that arise from this study. Some of the methodological, theoretical and practical implications will now be discussed.

Methodologically, the study has used a design that attempted to link micro-analyses of interaction with macro-analyses of context and change. More work needs to be undertaken to develop research designs that focus on the intersection of these two levels of analysis. A suggested way forward would be to extend micro-analytical frameworks, such as those found in interaction analysis (Hutchby & Wooffitt 1998). These frameworks provide useful strategies for data collection and analysis, but typically ignore any concepts that are not evident in the participants' speech (e.g., Taylor & Cameron 1987; Ten Have & Psathas 1995). However, as has been demonstrated in this Thesis, sometimes there are broader societal and institutional influences that are salient but are neither recognised by the interviewee nor evident in the interviewee's speech. Methods need to be found to capture the richness that qualitative data and

interaction analysis provide, but also to be able to link this back to the broader context in which the interaction is situated.

The study has used a method aimed at theory building to better understand the role of contexts on workplace learning. In doing so it revealed how certain contexts influence both accredited and informal learning, and how these contexts are changing, in one particular workplace. There is a need to test the theory developed, and the claims made in this Thesis, to assess whether the conclusions made using the data are generalisable to other workplace environments. Although this study has used a qualitative methodology based on an emergent research design (e.g., Denzin 1994), the research studies described above would more appropriately use a range of theory testing designs (e.g., Kerlinger 1986).

It is contended that important theoretical developments are being made as a result of cross-disciplinary studies (Engestrom & Middleton 1996a) and that this is a trend that will continue to yield useful outcomes in the future. Are current organisational and learning theories sufficient or do they require modification under these circumstances? Furthermore, do emerging workplaces, for example, require new concepts and theories (in terms of both organisational and learning theory) or do they fall comfortably within current ways of understanding workplaces? The findings presented here would indicate that they are different and provide different theoretical insights than workplaces in general, though more research needs to be undertaken (Wickens et al. 1997). There is, for example, a need to develop better theory to account for informal learning in workplaces. Although there is now increasing empirical research into accredited formal learning, there is still limited information available about the nature of informal workplace learning and this area needs more attention. The emerging characteristics of workplaces indicate that the pace of change is increasing, suggesting that in these environments employees will need "soft" skills, and "emergent knowledge" (21st Century Jobs for the 21st Century 1999; Imel 1999; Shaw & Fisher 1999). These findings highlight the importance of informal learning and the need to better understand how these processes can be supported and enhanced.

At a practical level, the claim made in this Thesis has been that the findings presented here are also pertinent to other workplaces characterised by High-3 work. More research is needed to ascertain if the findings presented here are salient in other High-3 workplaces. Do other High-3 workplaces (e.g., emergency services, surgical operating rooms, mining operations) have similar or different elements of structure and culture? What influence do different structures and cultures have on workplace learning? More research is also needed into the characteristics of what have been termed High-3 workplaces. What are the similarities and differences between High-3 work environments and other kinds of workplaces? More research attention needs to be given also to the issue of boundaries within and between organisational groups. Contemporary workplaces have "dynamic" groups that are changing constantly. Indeed, some have suggested that the notion of a stable team needs to be replaced by dynamic teams (Tomkins 1997). Under these circumstances, the structures and cultures that enable and constrain learning within such

dynamic groups (be they groups internal to the organisation or groups spanning the boundaries of organisations) need to be better understood. Finally, more research is also needed into better understanding the nature of organisational change and the possibilities for creating workplaces where continuous learning occurs within educative work environments.

12.4.2 Epilogue

It has been contended in this Thesis that learning in the workplace takes many forms and that these can be classified as accredited and informal learning. It has also been contended that contexts enable and constrain both forms of learning in important ways. If we are to take these contentions seriously then we need to consider carefully the impacts of the contexts we create on possibilities for learning in order to create educative work environments where learning is a continuous process. Workplaces and learning endeavours developed with this aim would:

- provide opportunities for rich individual and collective involvement in work activity that involves the processes of reflection and conceptualisation on experience and intentional experimentation;
- maximise the ways in which transitions between the processes of experience, reflection, conceptualisation and experimentation occur for individuals and groups;
- embed the transfer of insights from engagement in learning within and between individuals and groups in organisational structures and cultures;
- prioritise the role of group communication and interaction aimed at developing shared understanding and expanding possibilities for future action;
- constantly evaluate the impact of work structures and cultures from the perspective of learning.

A recent review of research (Imel 1999) suggests that “soft” or “emergent” knowledge is becoming increasingly more important and likely to be a defining feature of workplace learning in the coming century. Soft knowledge is, however, not easily communicated and is often tacit (Nonaka & Takeuchi 1995). Soft or emergent knowledge is fuzzy, in part because its properties are not yet known. Workplaces endeavouring to enhance such knowledge forms would require a processual approach to learning. Such reviews also highlight the importance of informal learning, as content is not yet known and, therefore, that informal learning is likely to increase in importance because of the rapid pace of changing environments. What this Thesis has demonstrated is that informal learning and a processual approach to investigating learning within work activity are also important because of the increasing complexity and abstraction found within contemporary workplaces. These trends all support the argument for exploring ways to enhance workplace learning and for investigating workplace structures and cultures for the ways in which they shape experience and enable or constrain processes involved in learning.

What this Thesis has provided are some insights into how learning in workplaces is mediated by contexts and how these contexts are changing. It has also identified some strategies aimed at enhancing workplace learning with a view to providing suggestions as to how educative work

environments might be created. This is, however, just the beginning of a research agenda of potentially great significance and I look forward to joining with others to further the goal of creating educative workplaces as sites of continuous learning.

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Appendix 1

Comments from AirServices staff on the dissertation

Alternate-Recipient: prohibited
Date: Tue, 11 May 1999 10:39:06 +1000
From: Mark Rilatt <MARK.RILATT@airservices.gov.au>
Subject: Access statement
To: "Christine.Owen" <Christine.Owen@utas.edu.au>
Mime-Version: 1.0
Posting-Date: Tue, 11 May 1999 10:39:06 +1000
Importance: normal
Priority: normal
Sensitivity: Company-Confidential
A1-Type: MAIL

Christine Owen
School of Secondary and Postcompulsory Education
PO 252C-66
Hobart Tasmania

Dear Christine,

Thankyou for passing on a copy of your PhD Dissertation: Learning in the Workplace: The case of air traffic control.

This e-mail is to confirm that, from Airservices Australia's perspective, the material contained within the Dissertation may be made available for loan and limited copying in accordance with the Copyright Act 1968.

Please don't hesitate to contact me on (02) 62685580 if you wish to discuss any further matters relating to your Dissertation.

Regards,

Mark Rilatt
Selection and Development Manager
Airservices Australia

Mr-Received: by mta SMITHY; Relayed; Mon, 15 Mar 1999 08:30:32 +1000
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Date: Mon, 15 Mar 1999 08:30:24 +1000
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Mime-Version: 1.0
Posting-Date: Mon, 15 Mar 1999 08:30:32 +1000
Importance: normal
Priority: normal
Sensitivity: Company-Confidential
A1-Type: MAIL
Hop-Count: 2

Christine Owen
Centre for Research and Learning in Regional Australia
School of Secondary and Postcompulsory Education
University of Tasmania

Dear Christine,

thanks for the opportunity to read your thesis, "Learning in the Workplace: the case of Air Traffic Control".

First, let me say that I found the work was a pleasure to read. I think this is largely due to the fact that the document puts a wide range of complex organisational and educational issues into a very self-contained "package". Having attempted to do this, in a work organisation sense, for the last six years, I find your effort even more note-worthy.

I think too, that the direct relevance of the thesis to the work I am involved in makes it a compelling read.

As to the content of the thesis, I find that the capture of the ATC work and learning environments is both accurate and appropriate. I also personally found that the linkages made to the literature were very helpful to me in crystallising some specific work issues.

The observations which you make within Section Three of the thesis are relevant and contain good counsel. As you know, much has been achieved in recent years, in relation to ATC training; however, the more holistic sense of learning in the ATC workplace remains a major challenge. I believe that your work will contribute significantly to answering this challenge.

Once again, thanks for the opportunity to read your work. Thanks also,

for choosing to undertake this important study, within the Air Traffic Control discipline in Australia.

MARK RILATT

Manager

ATC Selection and Development

Mr-Received: by mta SMITHY; Relayed; Thu, 18 Mar 1999 13:06:28 +1000
Mr-Received: by mta BRAIN; Relayed; Thu, 18 Mar 1999 13:09:27 +1000
Alternate-Recipient: prohibited
Date: Thu, 18 Mar 1999 12:36:33 +1000
From: Robert van den Dungen <robert.vandendungen@airservices.gov.au>
Subject: Learning in the workplace: The case of ATC
To: Christine Owen <Christine.Owen@utas.edu.au>
Mime-Version: 1.0
Posting-Date: Thu, 18 Mar 1999 13:06:00 +1000
Importance: normal
Priority: normal
A1-Type: MAIL
Hop-Count: 2

Dear Christine

Thank you very much for the opportunity to read the final draft of your thesis "Learning in the wokplace: the case of air traffic control".

I enjoyed the reading very much especially chapter 5 which I thought gave an excellent, at times brutally honest, insight into the culture and training environment of air traffic control in Australia. It reminded me that we still have a long way to go to achieve a fully effective training culture.

I also appreciated the practical and simple (therefore very achievable) suggestions you make in Chapter 12 that will supplement our simulator training and On-the-Job training.

You have also given us some insight into the issues of the future, some of which are preoccupying us so much at the moment. Even though we are used to handling changing traffic environments we are not used to coping with the constant change to the way we do business and the resultant impact on our training.

You'll be please to know that the new TAAATs simmulator allows full replay and with determination we will be able the get the teams to take advantage of this to increase the amount of reflective learning in our environment.

I have taken the liberty to correct some minor errors and typos and have forwarded them under seperate cover.

Yours Sincerly

Rob van den Dungen

Group Leader TAAATS Training
Southern District

Mr-Received: by mta SMITHY; Relayed; Thu, 18 Mar 1999 15:03:44 +1000

Mr-Received: by mta BRAIN; Relayed; Thu, 18 Mar 1999 15:06:45 +1000

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Date: Thu, 18 Mar 1999 13:02:18 +1000

From: "John A. Welsh" <john.welsh@airservices.gov.au>

Subject: Review of "Learning in the workplace"

To: "Christine.Owen" <Christine.Owen@utas.edu.au>

Mime-Version: 1.0

Posting-Date: Thu, 18 Mar 1999 15:03:00 +1000

Importance: normal

Priority: normal

A1-Type: MAIL

Hop-Count: 2

Dear Christine,

Congratulations on completion of your Thesis and thank you very much for the opportunity to review it and contribute some comments. I consider that this dissertation is one of the most important contributions to the understanding of how knowledge, skills and attitudes are acquired and developed in not only Air Traffic Control but in most "High 3" occupations (high-technology, high-intensity, high-reliability) evolving to meet the challenge of providing essential services in the new millenium.

I wish I could have had this document to read fifteen years ago when I decided to specialise in ATC training; you have managed to capture and describe most of the concepts that have taken me over a decade to arrive at after onerous trial and error. I simply could not put the paper down until I finished reading it. I recognised all too well the "Gun Controllers", the "adrenalin junkies", war stories, and the old "4X2" training mentality. I really did like the categorising of training strategies as "Acting On", "Working With" and "Working Against"; in my opinion, inappropriate "Working Against" in the past has cost this profession dearly in terms of unnecessary loss of staff and aspirations. In fact, I have just gone over these concepts with a simulator instructor to focus on desirable instructional techniques, so your document has been used usefully already.

I have found your Chapter 12 informative and challenging; there are some concepts in there that I have to reflect on as to how it could be introduced and accepted in the workplace (e.g. videoed performances), but as you know, I like to be challenged and, I hope, innovative.

Apart from an occassional "throw-back" episode, I am pleased that most of our OJTI in Perth is now of the "Working With" category, and it always gladdens me to come across a training dyad deep in analysis and reflection on performance.

I hope that this Thesis becomes compulsory reading for all

Airservices Managers, Team Leaders and OJTIs.

Thank you for letting me review and comment on this important work and again congratulations on its completion.

Kindest regards,

John Welsh (B.Bus)

ATC Training Specialist (W.A.)

Appendix 2

Schedule of questions used in the semi-structured interviews

APPENDIX SCHEDULE OF QUESTIONS USED IN THE SEMI-STRUCTURED INTERVIEWS

Examination of work-based learning and instruction

1. How long have you been in your existing position (e.g., OJT)?

Role as an instructor

2. If Instructor - Why did you become one?
3. How many trainees have you had? Over what time?

Most recent trainee

4. I/we are trying to develop an understanding of how on-the-job training occurs in ATC. Think back to your last trainee (or current one). Can you describe what happened: For example,
 - (a) when did you "take on" this person? Did you have a choice? How did you find out you were getting a trainee? Was there any contact (between you and the trainee) beforehand? What did you know about this person before they arrived?
 - (b) how did their training progress? Were there any times when they progressed quickly or slowly? Why do you think that was the case?
 - (c) What indicators did you use to know that the trainee was progressing? (i.e., What did you look for?). What kind of written documentation was kept? Where might I find it?
 - (d) Was the trainee or any aspect of their learning difficult? Why do you think this was?

- (e) Throughout the trainee's learning period, what contact did you have with - your team leader; the training annexe; others regarding the trainee? Can you describe examples of such contact/discussions? (Probe purpose, who initiated, resolutions).
- (f) Is what you have described a typical OJTI experience or is this one unusual? Why?

Trainees in general

- 5. When do you know a trainee is ready to be rated? What do you look for? Have you ever had a situation when the trainee was not progressing quickly enough or when you feared that they would not get a rating? What happened? (explore opportunities for feedback, remediation, when was the issue addressed, how, by whom)
- 6. Can you give an example of when you felt really good about being an instructor, a time when something really worked or "clicked" for you and your trainee? (probe why, explanations, actions, consequences, context)
- 7. Can you give an example of a time when you felt really frustrated about being an instructor, when something didn't work, perhaps when you felt that you were unsuccessful? (probe - why, explanations, actions consequences, context)
- 8. Have you ever talked with anyone in the organisation about a trainee or some aspect of your instruction? What was that about? (probe who initiated the discussion, actions, consequences).

Trainee learning - surprises

- 9. Are there any times when you have thought that someone was going to make it and they didn't? If yes, what happened?
- 10. Are there any times when you thought someone was not going to make it and they did? If yes, what happened?

11. A really powerful way of learning and sharing information in the CAA is through "war" stories. Are there any particular war stories about on-the-job-training instruction that come to mind?
12. Analogies. Some people describe being an instructor in this environment is like being a "hostage/captive" or being like a "ventriloquist/dummy". What's being an instructor like for you?
13. Have you ever had an "incident" when working as an OJTI? What happened?

Instruction

14. Here is a list of instructional behaviours that occur in typical learning contexts. (see end of Appendix - to be shown on a card) Do they occur here? How? When? Why (not)? (Explore perceived importance).
15. What is your assessment of OJT instruction in ATS? What is needed for it to improve?

Learning and the team

16. Are you in a team? How many people? How often do you meet as a team?
17. When you meet as a team, what do you do/discuss?
18. What effect has teams had on training and learning within the team? (If person around pre-teams) - what impact has being in a team had on trainee learning? (success/failure rate)

Learning, development and change

19. You have been an OJTI since .. , over that time you have probably noticed that some aspects of your instruction have improved. What aspects of instructing do you feel you have improved significantly in recent years?
20. What has helped you improve? What sources of help do you believe have enabled you to improve the aspects identified? Specifically, have any of the following been of help? (Provide on a card).
- On-the-job experience at instruction
 - working closely with one or two colleagues
 - discussions/advice with/from other staff
 - CAA OJTI program
 - CAA - other course
 - professional reading, non-formal study
 - study for a formal course
 - other courses outside CAA
 - other
21. In terms of your own development as an instructor, what aspects of instruction would you like to improve?
22. What sources of help do you believe would best assist you to make the improvements you wish to?

OJTI Training Programs

23. Have you undertaken an OJTI course? When?
24. In your opinion, what was the course like?
25. What did you learn? What parts of the course have remained with you?
26. Do you think you have changed the way you instruct as a result of the course? Why?

Work Organisation

27. Characteristics of the work environment. Attached are a set of criteria that describe some forms of work. Can you look over the criteria listed. To what degree are these characteristics present in your own work? Can you give me an example?

Instructional Behaviours - (shown on a card to the interviewee)

- Pre-planning learning opportunities on each shift
- Providing a pre-shift briefing
- Note-taking during the shift
- Providing a post-shift briefing
- Providing regular feedback of progress, including discussing options for change
- Using some kind of workbook/diary while training
- Other?

Characteristics of the work environment (on a card shown to the interviewee)

1. Task variety A person needs to be able to vary the work within a job.
2. Self-regulation A person should be able to pace him or herself and have some choice over work methods and work sequence. This 'elbow room' should not be so great that the person is left without direction or assistance.
3. Meaningfulness The job should give a sense of completeness and of meaningful contribution. The scope of the job should include all the tasks necessary to complete a product or process.
4. Learning The job should provide opportunities for continued learning. Learning on the job can take place when people are set meaningful goals, rather than just ordered to execute a set sequence of steps.
5. Mutual Support The job should provide conditions that enable a person to receive the help and respect of workmates.
6. Social contribution. The job should provide some form of meaningful contribution to the community well-being, and promote self-growth of the worker.
7. Other

Examination of work-based learning and instruction
Questions for existing or recent trainees

I'm interested in learning about your experience as a trainee and what you can tell me about training in ATS in general.

1. When were you in training? Why were you doing this training? (probe motivation).
2. Have you been a trainee before in ATS? In what contexts?
3. Think about your most recent training experience. Can you describe what happened in the training? For example (probe in terms of both off-the-job training and on-the-job training),
 - (a) what contact did you have with your instructor(s) before commencing?
 - (b) how did the training progress? Were there any times when it progressed quickly or slowly? Why do you think that was the case?
 - (c) How did you know that you were improving? (i.e, What did you look for in your own progress?). What kind of written documentation was kept? Where might I find it?
 - (d) What was your relationship like with your instructor(s)?
 - (e) Was any aspect of your learning difficult? Why do you think this was?
 - (f) Throughout your learning period, what contact did you have with - your team leader; the training annexe; others regarding your training?

- (g) In your opinion, is what you have described a typical training experience or was this one unusual?
4. Can you describe what happened when you were about to be rated. Did you feel ready? Why? Before rating, did you ever fear you were not progressing quickly enough and that you would not get a rating? What happened? (explore opportunities for feedback, remediation, when was the issue addressed, how, by whom)
 5. Can you give an example of when you felt really good in your training, a time when something really worked or "clicked" for you and/or your instructor? (probe why, explanations, actions, consequences, context)
 6. Can you give an example of a time when you felt really frustrated in your training, when something didn't work, perhaps when you felt that you were unsuccessful? (probe - why, explanations, actions consequences, context)
 7. Have you ever talked with anyone in the organisation about your training? What was that about? (probe who initiated the discussion, actions, consequences).
 8. A really powerful way of learning and sharing information in the CAA is through "war" stories. Are there any particular war stories about on-the-job-training instruction that come to mind?
 9. Analogies. Some people describe being in trainee in this environment is like being a "hostage/captive" or being like a "ventriloquist/dummy". What's being in training like for you?
 10. Have you ever had an incident? What happened? (Probe procedure - training, support, evaluation of the incident).

Instruction

- 11 Here is a list instructional behaviours that occur in typical learning contexts. Do they occur here? How? When? Why (why not)? (Explore perceived importance).
- 12 What is your assessment of OJT instruction in ATS? What is needed for it to improve?

Learning and the team

- 16 When you were a trainee, were you attached to a team? How many people? How often did you meet as a team?
- 17 When you met as a team, what did you do/discuss?
- 18 What influence do you think being in a team made to your your training and learning? (If been in system pre-teams as a trainee - probe improvement in opportunities for success)

Work Organisation

19. Characteristics of the work environment. Attached are a set of criteria that describe some forms of work. Can you look over the criteria listed. To what degree are these characteristics present in your own work? Can you give me an example?

Questions for key informants

1. How long have you been in this position? Why did you come into ...?
2. What do you do? Who do you work in with? What's that like?
3. There are a number of changes occurring in CAA/ASA. Can you describe to me how those changes have occurred? Why you believe they are occurring?
4. How does this unit/sector link in with the rest of the organisation? For example, how do you find out what's going on in this organisation? How do others in the organisation view this sector?
5. What's the culture like in the organisation? Can you give me some examples of the culture here? How does that enhance or inhibit (a) the work you do here?; (b) the effectiveness of the organisation?
7. A really powerful way of learning and sharing information in the CAA is through "war" stories. Are there any particular war stories that come to mind?
8. Are there any problems or dilemmas are you working on now?
9. How would you describe the challenges facing this organisation?
10. Characteristics of the work environment. Attached are a set of criteria that describe some forms of work. Can you look over the criteria listed. To what degree are these characteristics present in your own work? Can you give me an example?

Appendix 3

Ethical procedures followed in conducting interviews

STATEMENT OF INFORMED CONSENT FOR RESEARCH AND TEACHING PURPOSES

Work-based learning in Organisations

This interview is being conducted by Ms Christine Owen and will involve interviewing people working throughout the organisation. The purpose of the interview is to gain understanding about work-based learning, particularly how learning is shared within groups in the organisation. This study will help shed light on issues that are important for workplace learning.

You can help by responding in the interview as honestly as you can. The interview will be tape recorded if this is acceptable to you. This allows the researcher to concentrate on the discussion rather than on taking notes. The interview is entirely confidential. The interview will be recorded as "Name of Organisation: Interview number xx". No identifying details will be recorded in the transcript. The tape-recording will be erased once the study is completed. Until this time the recording will be kept in a locked cupboard on University premises. The study will involve interviewing approximately 100-150 people. The results will form part of a dissertation.

You do not have to answer any questions if you do not wish to. You may withdraw from this interview at any time without prejudice. This letter is to ask for your participation in the interview.

"I have read the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this study and understand that I may withdraw at any time. I agree that research data for the study may be published provided that I cannot be identified as a participant."

"I understand that this interview may be taped and that the tape will be erased once the study has been completed."

Signature

Date

"I have explained the purpose of this study and the implications of participation in it to the participant and I believe that consent is informed and that he/she understands the implications of participation."

.....

Christine Owen

School of Education,

University of Tasmania

Date

Appendix 4

Descriptive codes used for first phase of analysis

Q.S.R. NUD*IST Power version, revision 4.0.

Licensee: University of Tasmania.

PROJECT: ASA Interviews, User Chris's data, 5:06 pm, Aug 21, 1998.

- (1) /Descriptive
- (1 1) /Descriptive/Beliefstoward performance
- (1 1 1) /Descriptive/Beliefs/Beliefs-training
- (1 1 2) /Descriptive/Beliefs/Aims Training
- (1 1 2 1) /Descriptive/Beliefs/Intentions in training
- (1 1 2 2) /Descriptive/Beliefs/Intentions/working with/alongside
- (1 1 2 3) /Descriptive/Beliefs/working against
- (1 1 3) /Descriptive/Beliefs/Purpose OJTI tr
- (1 1 4) /Descriptive/Beliefs/orientation toward trainee

- (1 2) /Descriptive/on-job-tr
- (1 2 1) /Descriptive/on-job-tr/thinking about
- (1 2 1 1) /Descriptive/on-job-tr/thinking about/monitoring
- (1 2 1 2) /Descriptive/on-job-tr/thinking about/assessing
- (1 2 1 3) /Descriptive/on-job-tr/thinking about/evaluating
- (1 2 2) /Descriptive/on-job-tr/acting or intervening
- (1 2 2 1) /Descriptive/on-job-tr/acting or intervening/strategies
- (1 2 2 1 1) /Descriptive/on-job-tr/acting or intervening/strategies/working with trainee
- (1 2 2 1 2) /Descriptive/on-job-tr/acting or intervening/strategies/questioning
- (1 2 2 1 3) /Descriptive/on-job-tr/acting or intervening/strategies/observing
- (1 2 2 1 4) /Descriptive/on-job-tr/acting or intervening/strategies/feeding back
- (1 2 2 1 4 1) /Descriptive/on-job-tr/acting or intervening/strategies/feeding back/
- concerns
- (1 2 2 1 5) /Descriptive/on-job-tr/acting or intervening/strategies/telling
- (1 2 2 1 6) /Descriptive/on-job-tr/acting or intervening/strategies/taking over
- (1 2 2 1 7) /Descriptive/on-job-tr/acting or intervening/strategies/toughening
- (1 2 2 1 8) /Descriptive/on-job-tr/acting or intervening/strategies/ignoring
- (1 2 2 1 9) /Descriptive/on-job-tr/acting or intervening/strategies/reflecting
- (1 2 2 3) /Descriptive/on-job-tr/acting or intervening/rel with trainee
- (1 2 2 3 2) /Descriptive/on-job-tr/acting or intervening/rel with trainee/diffic comm
- (1 2 3) /Descriptive/on-job-tr/dilemmas

- (1 3) /Descriptive/experience
- (1 3 1) /Descriptive/experience/years in CAA
- (1 3 1 1) /Descriptive/experience/years in CAA/newcomer
- (1 3 1 2) /Descriptive/experience/years in CAA/middle
- (1 3 1 3) /Descriptive/experience/years in CAA/old timer

- (1 3 2) /Descriptive/experience/background
- (1 3 2 1) /Descriptive/experience/background/CcADSO
- (1 3 2 2) /Descriptive/experience/background/UToL
- (1 3 2 3) /Descriptive/experience/background/Short Course
- (1 3 2 4) /Descriptive/experience/background/Long Course
- (1 3 2 5) /Descriptive/experience/background/Flight Service

- (1 3 3) /Descriptive/experience/Instructor
- (1 3 3 1) /Descriptive/experience/Instructor/No. Trainess
- (1 3 3 1 1) /Descriptive/experience/Instructor/No. Trainees/1-5

(1 3 3 1 2)	/Descriptive/experience/Instructor/No. Trainees/6-10
(1 3 3 1 3)	/Descriptive/experience/Instructor/No. Trainees/11-15
(1 3 3 1 4)	/Descriptive/experience/Instructor/No. Trainees/16+
(1 3 3 2)	/Descriptive/experience/Instructor/Quals
(1 3 3 2 1)	/Descriptive/experience/Instructor/Quals/OJTI
(1 3 3 2 1 1)	/Descriptive/experience/Instructor/Quals/OJTI/less than 2 years
(1 3 3 2 1 2)	/Descriptive/experience/Instructor/Quals/OJTI/more than 2 years
(1 3 3 2 2)	/Descriptive/experience/Instructor/Quals/other ed
(1 3 3 2 3)	/Descriptive/experience/Instructor/Quals/other
(1 3 4)	/Descriptive/experience/current training
(1 3 4 1)	/Descriptive/experience/current training/Beg 1-2
(1 3 4 2)	/Descriptive/experience/current training/Midd 3-5
(1 3 4 3)	/Descriptive/experience/current training/End 5+
(1 4)	/Descriptive/Work activity
(1 4 1)	/Descriptive/Work activity/desc of current
(1 4 1 1)	/Descriptive/Work activity/desc of current/enroute
(1 4 1 1 2)	/Descriptive/Work activity/desc of current/enroute/rel enr-others
(1 4 1 2)	/Descriptive/Work activity/desc of current/arrivals
(1 4 1 2 1)	/Descriptive/Work activity/desc of current/arrivals/rel arr-others
(1 4 1 3)	/Descriptive/Work activity/desc of current/approach
(1 4 1 3 1)	/Descriptive/Work activity/desc of current/approach/rel app-others
(1 4 1 4)	/Descriptive/Work activity/desc of current/tower
(1 4 1 4 1)	/Descriptive/Work activity/desc of current/tower/rel tow-others
(1 4 1 5)	/Descriptive/Work activity/desc of current/general
(1 4 1 5 1)	/Descriptive/Work activity/desc of current/general/satisfying
(1 4 1 5 2)	/Descriptive/Work activity/desc of current/general/alienating
(1 4 1 6)	/Descriptive/Work activity/desc of current/war stories
(1 4 1 7)	/Descriptive/Work activity/desc of current/role of confidence
(1 4 1 8)	/Descriptive/Work activity/desc of current/role of war stories
(1 4 1 9)	/Descriptive/Work activity/desc of current/annexe
(1 4 2)	/Descriptive/Work activity/changes
(1 4 3)	/Descriptive/Work activity/desc training
(1 4 3 1)	/Descriptive/Work activity/desc training/tr effect on work practice
(1 4 3 2)	/Descriptive/Work activity/desc training/OJTI
(1 4 3 2 1)	/Descriptive/Work activity/desc training/OJTI/positive attitudes towards
(1 4 3 2 2)	/Descriptive/Work activity/desc training/OJTI/negative attitudes towards
(1 4 3 2 3)	/Descriptive/Work activity/desc training/OJTI/changes
(1 4 3 3)	/Descriptive/Work activity/desc training/linkages
(1 4 3 3 1)	/Descriptive/Work activity/desc training/linkages/within room
(1 4 3 3 2)	/Descriptive/Work activity/desc training/linkages/room-TA
(1 4 3 3 3)	/Descriptive/Work activity/desc training/linkages/other
(1 4 4)	/Descriptive/Work activity/teams
(1 4 4 1)	/Descriptive/Work activity/teams/positive attitude toward
(1 4 4 2)	/Descriptive/Work activity/teams/negative attitude toward
(1 4 4 3)	/Descriptive/Work activity/teams/impact on training
(1 4 5)	/Descriptive/Work activity/trainee

Appendix

Descriptive Data Analysis Codes

(1 4 5 1)	/Descriptive/Work activity/trainee/motives for training
(1 4 5 2)	/Descriptive/Work activity/trainee/desc from trainee's view
(1 5)	/Descriptive/culture
(1 5 1)	/Descriptive/culture/actions
(1 5 2)	/Descriptive/culture/(perceptions of others)
(1 5 3)	/Descriptive/culture/culture (perception of in general)
(2)	/Conceptual
(2 1)	/Conceptual/Learning
(2 1 1)	/Conceptual/Learning/Experience
(2 1 1 1)	/Conceptual/Learning/Experience/Physicality
(2 1 1 2)	/Conceptual/Learning/Experience/Complexity
(2 1 1 3)	/Conceptual/Learning/Experience/Interdependence
(2 1 1 4)	/Conceptual/Learning/Experience/Affective
(2 1 1 4 1)	/Conceptual/Learning/Experience/Affective/Confidence
(2 1 1 4 2)	/Conceptual/Learning/Experience/Affective/Job Satisfaction
(2 1 1 5)	/Conceptual/Learning/Experience/Sociality
(2 1 1 5 1)	/Conceptual/Learning/Experience/Sociality/Teams
(2 1 1 5 2)	/Conceptual/Learning/Experience/Sociality/Lateral linkages
(2 1 2)	/Conceptual/Learning/Reflections
(2 1 2 1)	/Conceptual/Learning/Reflections/role in instruction
(2 1 2 2)	/Conceptual/Learning/Reflections/war stories
(2 1 3)	/Conceptual/Learning/Conceptualising
(2 1 3 1)	/Conceptual/Learning/Conceptualising/culture
(2 1 3 1 1)	/Conceptual/Learning/Conceptualising/culture/communication
(2 1 3 2)	/Conceptual/Learning/ Conceptualising/Collective Values & Beliefs
(2 1 3 2 1)	/Conceptual/Learning/ Conceptualising/Collective Values & Beliefs/Confidence
(2 1 3 2 2)	/Conceptual/Learning/ Conceptualising/Collective Values & Beliefs/identity
(2 1 3 4)	/Conceptual/Learning/ Conceptualising/role of instructor - schemas/reasoning
(2 1 3 4 1)	/Conceptual/Learning/Conceptualising/role of instructor/gatekeeper
(2 1 3 4 2)	/Conceptual/Learning/Conceptualising/role of instructor/support - working with
(2 1 3 4 3)	/Conceptual/Learning/Conceptualising/role of instructor/acting on
(2 1 4)	/Conceptual/Learning/Experimentation
(2 1 4 1)	/Conceptual/Learning/Experimentation/teams
(2 4 5)	/Conceptual/Learning/Tech change
(2 4 5 1)	/Conceptual/Learning/Tech change/Impact on experience
(D)	//Document Annotations

Appendix 5

Application of the descriptive codes to an interview

Q.S.R. NUD*IST Power version, revision 4.0.
Licensee: University of Tasmania.

PROJECT: ASA Interviews, User Chris's data, 2:01 pm, Mar 15, 1999.

+++++
+++++
+++ ON-LINE DOCUMENT: Tape 70n
+++ Document Header:
* CAA Int 70, Arrivals, Controller, Brisbane

(1 1 1) /Descriptive/Beliefs/Beliefs-tr
++ Units:349-364

(1 1 4) /Descriptive/Beliefs/orientation toward trainee
++ Units:268-279

(1 2 1 2) /Descriptive/on-job-tr/thinking about/assessing
++ Units:142-165 228-258 286-315

(1 2 1 3) /Descriptive/on-job-tr/thinking about/evaluating
++ Units:136-141

(1 2 1 3) /Descriptive/on-job-tr/thinking about/evaluating
++ Units:256-261 315-340

(1 2 2 1) /Descriptive/on-job-tr/acting or intervening/strategies
++ Units:316-364

(1 2 2 1 4) /Descriptive/on-job-tr/acting or intervening/strategies/feeding back
++ Units:349-364

(1 2 2 3) /Descriptive/on-job-tr/acting or intervening/rel with trainee
++ Units:105-134 268-279 316-334

(1 2 2 3 2) /Descriptive/on-job-tr/acting or intervening/rel with trainee/difficulties
communicating
++ Units:316-334

(1 2 3) /Descriptive/on-job-tr/dilemmas
++ Units:190-224 286-315

(1 3 1 2) /Descriptive/experience/years in CAA/middle
++ Units:1-426

(1 3 2 4) /Descriptive/experience/background/Long
++ Units:1-426

(1 3 3 1 2) /Descriptive/experience/Instructor/No. Trainees/6-10
++ Units:1-426

(1 3 3 2 1) /Descriptive/experience/Instructor/Quals/OJTI
++ Units:1-426

(1 3 3 2 1 2) /Descriptive/experience/Instructor/Quals/OJTI/more than 2 years
++ Units:13-15

(1 4 1 2 1) /Descriptive/Work activity/desc of current/arrivals/rel arr-others
++ Units:262-279

(1 4 1 5) /Descriptive/Work activity/desc of current/general
 ++ Units:184-189

(1 4 1 6) /Descriptive/Work activity/desc of current/war stories
 ++ Units:371-376

(1 4 2) /Descriptive/Work activity/changes
 ++ Units:190-213

(1 4 3) /Descriptive/Work activity/desc training
 ++ Units:377-411

(1 4 3 2 1) /Descriptive/Work activity/desc training/OJTI/positive attitudes towards
 ++ Units:16-21

(1 4 3 3) /Descriptive/Work activity/desc training/linkages
 ++ Units:16-31

(1 4 3 3 2) /Descriptive/Work activity/desc training/linkages/room-TA
 ++ Units:228-249

(1 4 4 1) /Descriptive/Work activity/teams/positive attitude toward
 ++ Units:46-81 142-180

(1 4 4 3) /Descriptive/Work activity/teams/impact on training
 ++ Units:82-105

(2 1 1 4 1) /Conceptual/Learning/Experience/Affective/Confidence
 ++ Units:137-141

(2 1 1 4 2) /Conceptual/Learning/Experience/Affective/Job Satisfaction
 ++ Units:184-195 268-273

(2 1 1 5) /Conceptual/Learning/Experience/Sociality
 ++ Units:165-180 208-225

(2 1 1 5 2) /Conceptual/Learning/Experience/Sociality/Lateral linkages
 ++ Units:226-243

(2 1 2 2) /Conceptual/Learning/Reflections/war stories
 ++ Units:371-376

(2 1 3 1 1) /Conceptual/Learning/Conceptualising/Culture/Communication
 ++ Units:154-180

(2 1 3 2 1) /Conceptual/Learning/Conceptualising/Collective Values &
 Beliefs/Confidence
 ++ Units:295-297 313-315 420-420

(2 1 3 4 2) /Conceptual/Learning/Conceptualising/Collective Values & Beliefs
 ++ Units:356-364

(2 1 4) /Conceptual/Learning/Experimentation
 ++ Units:148-165

(2 1 4 1) /Conceptual/Learning/Experimentation/teams
 ++ Units:148-183

(2 4 5) /Conceptual/Learning/Tech change
 ++ Units:339-339 357-357

(2 4 5 1) /Conceptual/Learning/Tech change
 ++ Units:196-222 262-267

(T 1) //Text Searches/Text Search

++ Units:339-339 357-357

(T 5) //Text Searches/Text Search170

++ Units:296-296 314-314

(T 8) //Text Searches/Text Search173

++ Units:80-80 86-86 92-92 164-164 194-194 206-206 218-218 230-230
260-260 308-308 339-339 363-363 381-381

(T 12) //Text Searches/Text Search177

++ Units:260-260

+++ Retrieval for this document: 426 units out of 426, = 100%

++ Text units 1-426:

1

2 Side A

3

4 *I

5 Are you working as an instructor or a trainee?

6

7 *R

8 At the moment I am neither. I am an FPC upstairs but I have got a OJTI
rating so it can be used to train people, but I haven't for a while.

9

10 *I

11 How many trainees have you had over what kind of period?

12

13 *R

14 I did the OJTI course in '92 but obviously we had trainees before the
OJTI courses came in so I suppose I would say about eight trainees since
I was rated in '86.

15

16 *I

17 What did you think of the course that you did then?

18

19 *R

20 It was good but I didn't think it was very in-depth. They explored a few
things fairly well like short-term memory limitations, having a
structured plan of training. They are the two things that I came away
most with.

21

22 *I

23 Do you think it changed the way that you instructed?

24

25 *R

26 No, I don't think so. It probably made me think a bit more about
structuring the training and going through certain steps but not really -
not a great deal of change. I think it reinforced a lot of the things
that people were already doing on-the-job training.

27

28 *I

29 So it gave them labels that they could use.

30

31 *R

32 Yes.

33

34 *I

35 So as an FPC, do you check out people?

36

37 *R

38 No.

39

40 *I

41 You are not in that?

42

43 *R

44 The team leaders do the final checking. I think occasionally they have
an FPC do a progress check, some team leaders do, but it is up to the
team leader.

45

46 *I

47 So are you in a team?

48

49 *R

50 Yes.

51

52 *I

53 What is that like?

54

55 *R

56 Good. I like teams. I think they are good.

57

58 *I

59 Do you have team days?

60

61 *R

62 We do. We have team meetings and we have one probably once a month. We usually don't have a team meeting until we have got a number of agenda items or something big is happening.

63

64 *I

65 So what kinds of things do people talk about in teams?

66

67 *R

68 In the teams? Or in the team meetings? Or just general?

69

70 *I

71 In the team meetings.

72

73 *R

74 Team meetings usually we just talk about things that are changing, procedures that are going to change, that is mainly sort of it. Whether there is new rosters to be discussed or new procedures to be discussed or new procedures to be discussed, if there are any industrial type things going on we discuss those. That sort of thing.

75

76 *I

77 So how have teams changed the way that you work?
78

79 *R

80 Now we work basically with the same group of people each day. There is a little bit of mixing around the edges of the roster with other teams, but mainly your team of, say eight people come in together and go together. So you don't see all the staff as regularly as you do in the old system but I think it is better for trainees and also for new people to the centre because they get to XXXX a lot quicker than coming to a big centre and you see all these different faces every day. You don't really get to bond with any one.

81

82 *I

83 You have anticipated my next question because I was wondering what impact teams might have had on trainees. Has it increased or decreased to success or failure rate? What is your opinion?

84

85 *R

86 I don't know but would guess it should increase the success rate because the, especially when I came here for example, from Darwin they weren't in teams yet. I got allocated a training officer but by the end of my training, I had about five or six different people training me at various times because people would leave the roster and go on leave or whatever and it was only until the last two or three weeks of my training that I get one person. Whereas with a team, the team leader is obviously going to be told that there is someone coming in to their team and they are going to allocate someone who is going to be there for six weeks. Then when that person is in the team, he gets to meet with the same people and I just think it would help that person feel comfortable firstly being in the new environment, and then having a stable training regime.

87

88 *I

89 Yes, the continuity would have to be better.

90

91 *R

92 Yes. And the team leader is going to oversee his training as well. Whereas in the old system, each shift you would have a different supervisor for that cell, so they wouldn't know where you as a trainee were in your training. The training officer, this might be the first time he has ever seen you, as in my case. So it really doesn't help your training.

93

94 *I

95 Yes, it is pretty hit and miss.

96

97 *R

98 Then at the end of it, the check controller comes along and says "Well, you don't do that right, and you don't do that right, and what is going on here?". Which is similar to what happened to me.

99

100 *I

101 So I guess there is that lack of continuity so teams have improved that?

102

103 *R

104 Yes, I think they have.

105

106 *I

107 In terms of your last trainee that you had, how long ago was that?

108

109 *R

110 It was a while now. Probably at least a year ago that I was given, but I have had short periods of training someone over two shifts when their other training officer has been away but the last person I was assigned as a trainee was about a year and a bit ago on arrivals.

111

112 *I

113 So how did that go? Did you know that you were getting this person?

114

115 *R

116 Yes. That went well.

117

118 *I

119 Did their training kind of speed up or drop back at all at various times?

120

121 *R

122 No. It was pretty smooth training. He was an experienced controller. He ended up being a team leader. He was a team leader and he was just

getting all his ratings. He was a fairly easy trainee.
123

124 *I

125 So were there any times when you feared that he might not get his rating?
126

127 *R

128 No.
129

130 *I

131 Not really?
132

133 *R

134 No.
135

136 *I

137 What do you look for when somebody is getting close to a rating standard?
138

139 *R

140 Probably the biggest thing is initiative. They have to show that they are thinking ahead and they have to show that they are willing to do something to resolve problems and not continually looking around for you to do it. Usually a trainee in the early stages will, almost always. If something comes up he will either put a question mark in telling you what he would like to do or he will turn around and wait for you to tell him. Then you should be looking for someone to just get on and do it and knowing that the person behind them is going to jump in if they are doing something wrong, but not be afraid to make decisions.
141

142 *I

143 OK, somebody has got a rating, and in the period after the rating is also a time when learning continues ...
144

145 *R

146 A very steep curve.
147

148 *I

149 What is that like? Maybe from your own experience?
150

151 *R

152 It is a very important stage. Everyone sort of jokes but I think it is half a joke that you learn more in the first one or two weeks after rating than you have learnt in your six weeks training because you are sitting there and you have to do it. You learn by any mistakes that you make.

153

154 *I

155 How do you learn through that time?
156

157 *R

158 Basically by making mistakes and making the wrong decision and then having to revise it and you remember next time that doesn't work and you should try something else. Which happens I think quite a bit.

159

160 *I

161 Did you talk to anybody else about the mistakes that you make? Or is that something that is kept private?

162

163 *R

164 Obviously if it is a mistake that results in a error, then you have got to tell someone. I am talking about things where you decide something and it is not going to work and you change it. I think some people do ask other people how they do things. I think also you should keep asking people after you are rated - not be afraid to ask someone else's opinion on what to do. That is another thing that a team helps with, because you have already known those people so you are not afraid to say "Oh look. What do you reckon I should do here?". In the old system where you might be sitting next to someone that you have rarely ever worked with, it is a bit harder. You don't know if they are going to thing 'Oh you are rated, what are you asking me for?'. In a team it is more like friends help out.

165

166 *I

167 So in a team do they work in together?
168

169 *R

170 Yes, you generally do. You generally try and help each other out. In most of the sectors now, positions in the team are all next to each other

so you all sit together and so that information exchange is a lot easier than it would have been when you were isolated from the next sector. You weren't on the same roster as them so you didn't really know them. Now you are sort of a group and a group of sectors work a lot better I think.

171

172 *I

173 Can you give me an example of when the team is working really well together, what is that like? What kinds of things happen?

174

175 *R

176 It is just a lot easier. People anticipate what needs to be done and they sort of do it. The procedures I suppose are fairly strictly laid down for each position and what it should do, but when the team is working well, people do things for the other position without having to be asked. They anticipate a lot like co-ord and arranging. Mainly co-ordination and free cover or if an aircraft wants a change of level, then hopping in and asking the next sector for it so the other person doesn't have to do anything he can continue doing what he wants. That sort of thing happens.

177

178 *I

179 So you are making the work easier for one another?

180

181 *R

182 Yes.

183

184 *I

185 What do you really like about being an air traffic controller?

186

187 *R

188 That is a good question. I don't know. I know I like it but ... I just think it is an interesting job. It is not shuffling paper. I don't think I like writing reports and stuff like that. I don't think I would like to ... I never liked English. It is something that you can come in and sit down and play around with (if you like) and then go home and not have to worry about it.

189

190 *I

191 If you could change something about it, what would that be?

192

193 *R

194 I don't know. More money I suppose. No, I don't really know. I think
it is getting better with the technology. If you had asked a year ago
when we were still on the old stuff, then getting the new stuff would
have been the best thing they could do. It is going to get better in two
years so I think it is getting better.

195

196 *I

197 Do you work with the new technology?

198

199 *R

200 Yes. You haven't been upstairs yet? The new screens. They are really
good.

201

202 *I

203 So how is it different?

204

205 *R

206 It is easier because the old technology we were talking to the aeroplanes
a lot more finding out usually how high they were, because they didn't
have any height read out, and the radar coverage was limited to just
around Brisbane so the co-ordination was a lot more. They had to keep
the aeroplanes a lot further apart. It was just harder. You didn't have
an identification on them, you had to sort of do that yourself and move
and stuff. So when you were busy, you were really busy. It was easier
to make errors but now all the call-signs and levels are right there in
front of you. The radar goes all the way from Melbourne to Cairns so we
don't do nearly as much co-ordination with other sectors so it is a lot
quieter. You don't talk to the aeroplanes nearly as much so you can
process a lot more without getting busy.

207

208 *I

209 Is that difficult to adjust to?

210

211 *R

212 No. It was very easy.

213

214 *I

215 Someone said that it is now more difficult to work out what the trainee is thinking because in the past, you could anticipate what they were thinking by the kinds of questions they were asking, whereas now you can't. What is your thoughts on that?

216

217 *R

218 I haven't trained anyone on the new equipment - not a new controller. I think that is probably right because a lot of the time you are sitting back watching what is going on, whereas in the old days you did have to do a lot more forward planning I think. So the trainees minds would probably ticking over more before because it was probably a bit scarier. You would have to think more about 'If this guy gets away now, what am I going to do here and there'. Whereas now, you can watch it a lot more because everything comes up in front of you a lot earlier. I suppose that would be right. It is probably a case of asking the trainee more questions than you would have before.

219

220 *I

221 So you have got to have closer interactions and linkages?

222

223 *R

224 Yes.

225

226 *I

227 In your experience with trainees in general, what is a typical learning curve like?

228

229 *R

230 Probably fairly flat to begin with and then it gets steeper near the end I would think. Most trainees take a while because it is all new to them. They come out of the college and they have done college stuff but as soon as they are in the Centre, then it is all new geography and all the procedures are usually different. Every time I have done training in the College and then come into the field, it is the old thing 'throw out whatever you have learnt in the College. It is all different'.

231

232 *I

233 Why is that?

234

235 *R

236 I don't know. Either the colleges don't seem to communicate what is actually happening in the real world or it filters back months later or whatever. There seems to be a lag as to what is happening in the field and what is happening in the college. They don't follow each other. When the trainees come out, there is XXXX where ... at Henty House we did a procedural thing and it was very, very busy and the first thing I realised was if any of the centres were really that busy procedurally, I would get radar. So they come out and they have got different ideas on procedures. I suppose between Melbourne and Brisbane they are different, probably different procedures anyway. They have got different equipment and stuff.

237

238 *I

239 So because the centre was (when it was at Henty House) down in Melbourne, they might have been closer to what Melbourne practices were?

240

241 *R

242 Yes. They actually used Melbourne air space I think. I understand they came to a mutual-type XXXX. Yes, so they have got to learn new geography and new procedures. Probably the equipment is different. Almost every centre had different equipment. When I first joined, say air traffic equipment, it just takes a while to get that and then they start actually learning what you are trying to achieve on the position and that comes later.

243

244 *I

245 In terms of them, they need to learn the local area knowledge? Like where things are?

246

247 *R

248 Yes.

249

250 *I

251 Then what happens? What is the first thing that clicks in?

252

253 *R

254 I don't know if there is one thing that... I think that (on arrivals any way), once they realise that they need to take the initiative and achieve something (on arrivals it is an orderly sequence), and once they understand what the sector tries to achieve then things become a bit easier. It did for me any way.

255

256 *I

257 What is the easiest and the hardest part of the job to learn?
258

259 *R

260 I don't know. I suppose the hardest part on arrivals is mainly aircraft performance and relative performance of aircraft so you know who is faster than who and who flies better. That is probably the hardest. With the new stuff, it is a bit easier because it basically tells you - you can see by the labels how fast they are flying so you learn a lot quicker by watching. In the old days you couldn't see, you could only ask them what level they were or XXXX bigger than them.

261

262 *I

263 What is the linkage like between arrivals and approach, and en-route?
How does all of that work?

264

265 *R

266 Pretty good. We used to work closer with approach - physically closer in the centre and we are across the room from them now so the co-ords probably ... it is more important to be accurate with your co-ord, but again, the equipment that has come in has meant the co-ords become less anyway. The co-ord is semi-complicated before but it is extremely simple now. Because you don't work next to them so much, you don't get to know them that well so there are sometimes some friction. If they think you have done something wrong and you have done something wrong, whereas before you could sort it out XXXX each other. We are just another en-route grouping even though we have got arrivals. Between en-route there is usually no problem. The other thing with the way that they have got teams here in Brisbane is that, as it happens, most of the rosters are very similar so you will find that our team will work with the same teams on the other groupings so virtually every day you come in it is the same faces in the whole room. Which I think can help as well because then you get to know, not to share a team, but the next sector's teams working along side of you. Which gives you the same sort of bonding within the team.

267

268 *I

269 Back to the OJTI for a second. Why did you decide you wanted to be an OJTI?

270

271 *R

272 I suppose I enjoyed training people. Teaching people how to do things.

Seeing them learn.

273

274 *I

275 Can you think of an example of where you felt really good about being an
instructor and when things have really worked?

276

277 *R

278 I don't have a specific example but I suppose any time where you see the
trainee has used their initiative and has decided to solve the problem
and have got it right and you feel that is because of your training one
or two days before. Usually in most sectors, the same things happen and
basically the same conflictions come up every day so it is when you start
seeing that the trainee, after the two weeks of looking around at you at
this problem and saying "Should I do this?" because they don't really
understand the concept. Then all of a sudden one day they remember how
to do it. Or even better I suppose, if they come up where the problem
isn't quite the same and they come up with a solution of their own which
works.

279

280 *I

281 So you can see that they have taken that knowledge?

282

283 *R

284 They have got the concept and it works and it is great. They have got
the concept of what is going on and not just copying what they have been
doing. XXXX better way.

285

286 *I

287 What about an example of when you have felt really frustrated and
disappointed and things haven't worked?

288

289 *R

290 Again, I haven't really got a specific example, but I suppose you always
get trainees that seem to take longer or they are just continually want
the trainer to initiate something.

291

292 *I

293 So they are dependant on you?

294

295 *R

296 Yes, and they are scared to make a decision even though you tell them "Look, you do it and I will tell you straight away if I think it is going to be wrong", but it is a lot better for their confidence to let a trainee feel that they are doing the job because the longer they go doing the job without you saying anything, the more confidence they get that they are doing it on their own and they are doing it properly. From the other way, that is how I feel when I am being trained. It is unhelpful for training officers to be over your shoulder and a step ahead of you the whole time telling you what to do because you just don't learn anything.

297

298 *I

299 So you have got to know when to start to pull back, or when to intervene?

300

301 *R

302 Yes, that is right. A new trainee at the first two weeks (or whatever time) you basically do tell them what to say all the time because they don't really know what is going on, but then you expect at some point that you can just wait and see what they are going to do. It can get frustrating - some trainees just don't ever want to do it themselves.

303

304 *I

305 What do you do them?

306

307 *R

308 You just have to tell them. You just have to say "Well I am not going ...". You just sit back with your hands folded and say "I am not saying anything. You do it". That does happen. They will look round and you say "Well you do it". If they don't ever want to do it, they may as well not be trained.

309

310 *I

311 So they have got to get ...

312

313 *R

314 Yes. Of course as soon as they start doing it, then most of them find the confidence and then they hopefully just keep going on.

315

316 *I

317 What about these instructional type behaviours? What do you think about them? The degree to which they are relevant or used?

318

319

320 Tape runs out Side A

321

322

323 Side B

324

325

326 *R

327 because of the nature of the job, you don't know what opportunities will come up. I suppose you can guess a few things. The other thing that is good is that you can make some stuff up. You can say "What if someone taxis somewhere?" and "What if this guy wants to change level?". I think you probably need to pre-think about, after a few shifts, start to think about what you want a trainee to do more of or less of than something about going through some of those things on a shift.

328

329 *I

330 Does that happen?

331

332 *R

333 I don't know. It doesn't happen a great deal. I think subconsciously, people think 'Oh well, let's see if we can get our set courses time right today' and sort of say to them "Come on try a bit better".

334

335 *I

336 Set courses.

337

338 *R

339 The holding. On arrivals that is one of the main things when they are holding is to get them to come in at the right time. Or get your responses to approach a bit quicker or whatever so you can sort of think about that and maybe mention that to the trainee before or during the shift. I think note taking is very important, especially for av initio trainees. You have got to take notes so that you can give them a decent post-shift briefing, so I think it is definitely important for the trainee. Note taking is important so that you can give that briefing. I think all trainees really appreciate being told afterwards what they did right, especially, and what they did wrong as well. And what they have got to start to think about doing in the next group of shifts or the next shift.

340

341 *I

342 Yes. Was that in your own training?

343

344 *R

345 In the OJTI course ... I don't know if they specifically mentioned note taking.

346

347 *I

348 I was thinking about when you were a trainee.

349

350 *R

351 Yes, most of the times when I was training, people ... maybe not on every shift, but definitely on my progress checks and check shifts. I must admit when I was training on arrivals ... most of those training officers were only going to have me for one or two shifts I XXXX care. They weren't about to start taking notes and giving a critique. They were "Yes, thanks, see you".

352

353 *I

354 So you were supposed to pick it up through osmosis?

355

356 *R

357 Yes. It was a bit like that. My final training officer who I had for the last two weeks, he definitely took notes and he was very good. Very good. He definitely took notes and we had a discussion at the end of each shift. I definitely think you should provide regular feedback and the options.

358

359 *I

360 Does that happen?

361

362 *R

363 I think so. Most training officers do that because really, your job is really trying to get them rated so if you don't think they are going to get rated or you think they need to improve here or there, you should definitely have to tell them and discuss some techniques that you came up with. Say that you have got your rating and stuff like that. They are

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PROJECT: ASA Interviews, User Chris's data, 8:00 am, Sept 26, 1998.

(T 5) //Text Searches/Text Search170

*** Definition:

Search for 'confidence', No restriction

+++++

+++ ON-LINE DOCUMENT: CAA - 49n

+++ Retrieval for this document: 5 units out of 604, = 0.83%

66 *R

++ Text units 67-67:

67 .I think basically she was slow, so her speed was a problem. She knew the information, but I think her problem was just putting into practice. You could ask her questions theoretically and she didn't have a problem with that. She understood the concepts of separation and everything like that but just putting it into practice. I don't know if her concept of three dimensional ... I really don't know. If we could have figured out what the problem was, maybe we could have helped her. We didn't actually know exactly what the problem was it was just that it wasn't happening. It wasn't up to speed. Her problem was that she was very emotional and she would get through an exercise and things would start to go wrong and she would go down. You would just say "Don't let it get to you, you can't have that attitude in this job because people see that and they straight away think 'she can't do it'". She just let all of her feelings come through and that was a real big problem because you would get a team leader sit with you and things start to go wrong and you start doing that, people are just going to have no confidence in you what-so-ever. You have got to basically bluff your way. She knew what she was doing, but because she wasn't getting on top of it, instead of just working harder and getting on top she would just go "Oh, that's it. I've had it. It's too hard". We didn't know what to do. One of the other guys, she'd get annoyed with him because he talked too much to her. I wanted to be a friend. I didn't know whether I should ring her at home and speak to her. You just don't know what to do. You don't want to seem like you are looking down on her, which I definitely wasn't. I just wanted to help but you would try to talk to her and she would burst into tears. It was really horrible. You would come into the classroom saying "how are you going" and she would start crying and run out of the room.

90 *R

++ Text units 91-91:

91 .That's exactly right, because what ended up happening is she came back and did remedial, went back out, came back, did more remedial. That doesn't do anything for your confidence either. I didn't have much to do with her once she left the simulator but I know when came down here I think two or three times for a week. That doesn't help her. Knowing how emotional she was it wouldn't have done her confidence any good. I have never had anyone else. People get upset. I don't know if it is the difference between the guys and the girls as well. The guys if they do something wrong, they usually get angry at themselves, whereas this girl just broke down basically. It is a bit of an awkward situation.

96 *R

++ Text units 97-97:

97 .Yes. That shouldn't be so, but I think it is. It wasn't so much that she would give up but her voice would go like down the XXXXXXXX as if she'd given in. Not always she would throw it. She did that once or twice. Actually walked off. A lot of time you could just see it. It would get busy and you could see her going down because she was letting herself go down. I think it is part of the culture that you have to sound confident. It is not just for us, it is for the pilot's sake as

you go up there. Equipment, frequencies and this, that and the other which we have got now which will be very handy to train people with. That is about it. Whether you have got a structured curriculum and you know a little bit about training techniques and short-term memory stuff and how to go through teaching someone - showing and doing and all that sort of stuff. How to talk.

382

383 *I

384 If you were about to get a trainee tomorrow, what kind of development of your own instructional capabilities would you like to be working on?

385

386 *R

387 I don't know.

388

389 *I

390 Nothing springs to mind?

391

392 *R

393 Not really, no.

394

395 *I

396 OK. That's fair enough. It is difficult if it is a situation that you haven't been in for a while.

397

398 *R

399 Yes I haven't for a while.

400

401 *I

402 You are not trying to struggle with a particular trainee.

403

404 *R

405 I would probably just like to make sure a structured and tried to teach something each day as well as the actual what is happening at the time.

406

407 *I

408 With the trainees that you have had, was any part of the instruction

really difficult?

409

410 *R

411 Not that I can remember, no.

412

413 *I

414 Fair enough. It is a bit far away. Well thanks for this. Are you
comfortable if I use this?

415

416 *R

417 Yes, that is fine.

418

419 *I

420 OK. Well I will just give you an assurance of confidentiality about how
I am using it. I am running around the countryside talking with 100-150
people. I will be writing a report. The first couple of paragraphs of
this are the same, but if you are comfortable with me using this, then I
will ask you to say so.

421

422 *R

423 Yes that is great. Do you want me to ...

424

425 *I

426 Yes.

Appendix 6

Example of data attached at a Node and of a Node memo

Q.S.R. NUD*IST Power version, revision 4.0.
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PROJECT: ASA Interviews, User Chris's data, 8:00 am, Sept 26, 1998.
*****CONFIDENCE MEMO

LOG: 11:56 am, 1/23/96. : Cut from node (5) .

LOG: 1:30 pm, 1/23/96. : Cut from node (2 5) .

LOG: 1:30 pm, 4/15/96. :

.....
In many ways the crux of the issue is confidence. If you sound like its getting on top of you and you're too busy - pilots and others lose confidence in your abilities. - SEE Int 49 - instructor, ATC Melbourne, young

The controller needs to have confidence in his or her decisions and capabilities. The successful operation of the system means that others (other controllers and pilots) also need to have confidence in the controllers capabilities. For example, (see Ashleigh Merrit story, last AvPA Conference) a recent accident in the United States where the pilot brought an aircraft down after, resulted in the loss of 114 lives, yet could have been a lot worse. Following the accident, he pilot stated that the calm approach taken by the tower controller helped him to manage his own panic about the situation..

INT 49: Letting your feelings through is considered a problem. Straight away people will think "she can't do it"

Voice important in confidence - can't let voice go down. Must sound confident.

Int 49: "You have got to basically bluff your way" - are these strategies newly rated controllers use? Check out!

This sets up conditions where people are disinclined to reveal what they are uncertain about. Limits learning - listen to tape of Int 51 again - if someone is unsure about their confidence - will react in a hostile way.

It is important that trainees and instructors can express their needs (for different reasons). Trainees need to be aware of their rights and responsibilities and to have procedures explained such that they are aware of what avenues are

available to them if they feel they are dissatisfied with any aspect of their training and progress.

Trainees need to be able to assertively communicate any concerns they may have. Trainees and instructors need an understanding of issues of power in training relationship. -Include in ASA Evaluation.

Belief in ability exacerbated by stringent testing requirements to get in. Leads to belief that people only need ability to do the job - limited requirement for learning - no emphasis on learning. - How does this fit with role of confidence?

For a lot of people, the job is learned by osmosis. (See Int 93)

Idea of debrief - organisation could display their value for debrief by establishing debrief teams to assist people to debrief after having handled particular emergencies or unusual scenarios that occur (and to facilitate the organisation learning from these situations). A number of people commented that situations had occurred that they felt that they handled well, but that nobody discussed it with them afterwards. What effect does this have on performance - links back with confidence.

LOG: 3:10 pm, 5/29/96. :

See Tape 73 - Remedial training - lowers confidence - so getting through in the minimum time is important (otherwise "stigma" attached), unless attribution for need for extra training is external to the individual (for example, not having had many busy shifts). Check out locus of control theories.

Confidence is also built up by experience. But this takes a long time. People in approach for example, are regarded as new kids on the block for 3 years. The type of experience is also important, for example if you have not experienced particular weather conditions.

LOG: 11:56 am, 8/12/96.

69 - Trainee on approach, Brisbane

"I know within myself if I have done a good job" - evidence of internal locus of control - links with his inner confidence

Encouragement and verbalisation by the instructor is very important to the trainee. Difficulties occur however, when instructors use this strategy to boost

confidence (see esp ints Int 84 and 86), yet at the same time have concerns about the trainee's performance or progress that they do not raise.

The main thing with a trainee is to build up their confidence. ... you find out their weaknesses and you say 'you can do it', even if you yourself say 'he's never going to make it', you still have to push their confidence. If you say, 'he's never going to make it, or he's making the same mistakes time and time again, you can't say 'I'm going to make sure this bloke doesn't get through' you must say 'this person is going to make it, I'm going to fight till the end', okay, I'm writing reports that say they're not doing too well but I can't say to them 'I've given up on you' and you have to boost their confidence (Int 94).

In this instance, the instructor believes that to express concerns is to suggest that he has given up on the trainee, that it is incumbent upon the instructor to persist with the trainee and fight to the end. In these instances, confidence is linked to capability. With confidence will come increased performance.

Trainees commented on the value of the debrief but noted that debriefs were not commonly used.

"For other people it's like, its the end of the day so 'I'll see you tomorrow'. To me, I would like to talk about how people went and how they thought they went because a person can go home devastated and feel that they are absolutely worthless " Int 69

Int 69. Sometimes trainees use strategies of avoiding work, by taking a sickie if the previous shift was a bad one and they felt their confidence levels were threatened. This was an attempt to block a downward spiral of confidence. Others believe that such a strategy would be detrimental to their skills development, noting that even after two days away from the console they notice a significant decline in their skill levels and performance.

In training the person, I could see that they had the confidence to do the job. I didn't start off with the mind set that they would get rated, but I guess I knew after about 4-5 weeks.

LOG: 11:56 am, 3/15/97.

A problem arises when people act confidently but there is little confidence in their competence or ability by other controllers. In these instances - they use "bluff and bravado

When a training program is extended and the training protracted due to difficulties, there is a perception that an ability the person might have had is lost, due to loss of confidence.

confidence is the link between the personal and the presentation of the social self. Others express confidence as part of an aid to traffic management (see Int 121) Therefore, engaging in the impression of confidence is an important component of doing the job - because of its interdependence - they use their voices to display calm and confidence to everyone else, even if they feel they are getting overloaded. This both enables and constrains learning - see Int 64 - what happens when people are not confident - they hide what they don't know. People who are arrogant (is arrogance a continuum of confidence or something else?) are happy to reveal what they don't know.

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PROJECT: ASA Interviews, User Chris's data, 8:00 am, Sept 26, 1998.

(T 5) //Text Searches/Text Search170

*** Definition:

Search for 'confidence', No restriction

+++++

+++ ON-LINE DOCUMENT: CAA - 49n

+++ Retrieval for this document: 5 units out of 604, = 0.83%

66 *R

++ Text units 67-67:

67 .I think basically she was slow, so her speed was a problem. She knew the information, but I think her problem was just putting into practice. You could ask her questions theoretically and she didn't have a problem with that. She understood the concepts of separation and everything like that but just putting it into practice. I don't know if her concept of three dimensional ... I really don't know. If we could have figured out what the problem was, maybe we could have helped her. We didn't actually know exactly what the problem was it was just that it wasn't happening. It wasn't up to speed. Her problem was that she was very emotional and she would get through an exercise and things would start to go wrong and she would go down. You would just say "Don't let it get to you, you can't have that attitude in this job because people see that and they straight away think 'she can't do it'". She just let all of her feelings come through and that was a real big problem because you would get a team leader sit with you and things start to go wrong and you start doing that, people are just going to have no confidence in you what-so-ever. You have got to basically bluff your way. She knew what she was doing, but because she wasn't getting on top of it, instead of just working harder and getting on top she would just go "Oh, that's it. I've had it. It's too hard". We didn't know what to do. One of the other guys, she'd get annoyed with him because he talked too much to her. I wanted to be a friend. I didn't know whether I should ring her at home and speak to her. You just don't know what to do. You don't want to seem like you are looking down on her, which I definitely wasn't. I just wanted to help but you would try to talk to her and she would burst into tears. It was really horrible. You would come into the classroom saying "how are you going" and she would start crying and run out of the room.

90 *R

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96 *R

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well. You get busy, but if you push through even though you think 'Oh my God, I'm busy' you can get through it but if you start sounding like things are getting on top of you, the pilots lose confidence. Everyone around you starts going 'God what's she doing?'. It's not really the environment where you are encouraged to show emotion I don't think.

372 *R

++ Text units 373-373:

373 .Yes. Every time you do something you are thinking 'That didn't really work very well. I could have done it better. Next time I'll do it this way.' You are constantly doing that all the time. Also, being by yourself, you are forced into making decisions and you become protective of your licence and you want to do everything really safely and early and you don't sit on things. Sometimes you take the really easy option rather than working because you could do it, but it is going to be hard work - I'll take the safe option for a while. Which is fine. That is just experience as well. Once you get more experience, more confidence you do a bit more of the difficult things. Like the learning curve you have at the very beginning, you have again when you get rated. Just being on your own and just stuffing up. Hopefully it is never a major thing, but just little things. You think 'God, stupid. I won't do that again.'. You learn every day. You still do if you don't learn from your mistakes.

573 *I

++ Text units 574-574:

574 .You have increased in your confidence about asking questions?

+++ ON-LINE DOCUMENT: CAA - 69n

+++ Retrieval for this document: 5 units out of 739, = 0.68%

147 *R

++ Text units 148-148:

148 I think where I am now is very much within myself, what I judge is good. Like I know within myself if I have done a good job. Sometimes the training officer will say "you've done a good job" and I will think "yeah, I did". It hadn't occurred to me. I think the encouragement and the verbalisation that you have done a good job is very important. At the end of the day debrief. I know with my training in Cairns, at the end of every session, we went outside and we talked about it and I said "well, how do you feel?" and all this kind of stuff. She probably would focus on the negative stuff and I would say "Yes, you did that, but you also did this really well and I can see that you are getting on". Whereas, I know that other people don't think, I guess I am interested in training as well. Other people don't look for that. They just of like it is the end of the day so I'll see you tomorrow. To me, I would like to talk about how people went and how they thought they went, especially if it has been a really bad day because a person can go home absolutely devastated and feel that they are absolutely worthless. I think at least if they get to talk about it, that part of that is out, you focus on things and you are just saying "Well, what have you learnt from that? and then that is the starting point for the next day whereas I know that, for me, like that day that I took a sickie, I just couldn't face going. The next day I went in to a very good shift, a really good shift. If I had come in and done that other shift, I don't think I would have done very well and then it would have been a downward spiral. For me, I knew within myself, although I spoke to one of my friends who is a team leader here, and I said "well, what do you think?'. I couldn't decide. I knew I didn't want to go into work but I felt like I should. She goes "Well, you know your confidence is down and you will only start heading down". I think I knew that within myself that is where I would have gone if I had gone in on that shift. I think, in retrospect, I cut off the downward spiral by taking the day off.

169 *R

++ Text units 170-170:

170 I finished the training after ... I was coming away. The person that I

was training had the confidence to do the job which, on approach in particular is very important. I probably say four or five week. I was very optimistic to begin with, I didn't think my mind set was that this person was going to get rated to start with. I was quite optimistic that she wouldn't have any problem.

196 *I

++ Text units 197-197:

197 How's your confidence level about rating? Do you think you'll get it?

229 *R

++ Text units 230-230:

230 Phraseology. That's the first thing to try and get down pat, which is where Cairns suffers because they don't have a really good simulator. Whereas here, apart from the fact that we've done it before, the fact that you get to go through the simulator and do the phraseology is, I think the normal course is six or seven weeks down here. It would build up your confidence so much more because you are not tripping over your words and embarrassing yourself. The phraseology just getting the right patter down telling the aircraft what to expect and what to do and all that kind of stuff so that it sounds like you know what you are doing, but which, I think you build up on it.

486 *I

++ Text units 487-487:

487 Well that is an improvement in confidence and in openness about that and what you were describing before about that awareness, that's a really subtle thing that you are sort of detecting certain elements that are quite hidden. That's a complex business.

+++++

+++ ON-LINE DOCUMENT: CAA - 94n

+++ Retrieval for this document: 2 units out of 67, = 3.0%

++ Text units 34-34:

34 The main thing with a trainee is to build up their confidence. They've been in assessment day in day out for the last three months, they've had it in the simulator for two months, and they're still being checked every day and they have been put through a mental mangle over that six months and you have to boost their confidence, you find out their weaknesses and you say 'you can do it', even if you yourself say 'he's never going to make it', you still have to push their confidence. If you say, 'he's never going to make it, or he's making the same mistakes time and time again, you can't say 'I'm going to make sure this bloke doesn't get through' you must say 'this person is going to make it, I'm going to fight till the end, okay, I'm writing reports that say they're not doing too well but I can't say to them "I've given up on you" and you have to boost their confidence and say "with your confidence, if you start getting a few things right, when you start getting a few things right, you'll start being more confident and that, and you'll find yourself doing it by second nature and you'll be able to start concentrating on other things"

39 *R

++ Text units 40-40:

40 If you think that they're not going to make it, which is the potential of this one we've got at the moment, he may not make it, ah... he's going to be a long job if he does,...its got to be change of attitude if he does, I'm quite happy to persist and persist and persist, as long as we're progressing, then it becomes his decision. He has to turn around and say "I'm not getting anywhere" and I said "well, do you think that?" and if they say "we'll, I'm still doing that and the reports are still saying the same thing, I don't reckon I'm going to achieve it" then you have to step in and say and them the confidence thing and say 'you are going to make it' or say ' why don't you think you're going to make it?' and talk it through that way. I've had people say, "I'm quitting" and I've talked them back into it and they've got there.

+++++

+++ ON-LINE DOCUMENT: CAA Int 48n

+++ Retrieval for this document: 8 units out of 399, = 2.0%

47 *R

++ Text units 48-48:

48 Um, I don't think there's any doubt, and it's partially true that approach is a lot more difficult. So therefore, the people that do it, possible regard themselves a bit better and I think that they've been in the job for long enough that they've actually forgotten what it's like to be starting out. So sometimes, and this is a bit of a generalisation, because its not always the case, is that there's a lack of respect, even in that area, its minor but its definitely there, they think that they're good controllers and I suppose that they have to have that element in them to be able to do the job, so its not necessarily a criticism but it's there - an example of that is that sector four, which is the Western part of Victoria and filters all the stuff from Adelaide and everything south bound out of Brisbane and places like that, they are junior controllers, abinitio just rated sort of people and they have a direct relationship with the flow, who's probably the most senior controller in the room so you've got possibly one of the most junior people relating to one of the most junior people and this one lacks the confidence to say, no I'm going to do it this way and the flow is used to being able to say, "this is what I want - do it" and that has created problems because I know that, and I have suffered from it a bit, that I'm not aware of where my ground is, but that I'm a lot more prepared to get down to plain English and say okay this - I don't like the way you want to do this, whereas some of the less adult controllers don't have the confidence to say "can you hang on a minute, can you see why it is that I'm not happy about that"... whatever the requirement or the result that he's looking for.

53 *R

++ Text units 54-54:

54 Well, in an operation sense, no, because, you will do it this way if it comes down to the final straw because we've got to keep these two aeroplanes apart and I've got to be able to make sure that I can land two and get one away so, when it gets to the end result, if one sector was not working well with another sector, the team leaders will get together and they'll have to resolve it, but if there's reason for the conflict then they'll have to resolve that as well. I've never seen it get to that stage, but I've seen some people with initiative, when they've finished with sector 4 they'll go across to the flow and say, explain to me why that is - because he has got more experience and he's looking at a lot of different aeroplanes and you're just looking at yours so its difficult to see what the big picture might be and you may not have time to flick the radar around and see why he wants me to do that and I think receptions pretty good, if you go over and say - "didn't understand that - did it but tell me why" essentially, you'll get a pretty good response, but you won't always, so there's an element that says that communication is great but sometimes you get a negative response like "you should know better than that" and they forget that this person might have only been rated a week. And they can't predict how busy its going to get after they've been rated a week and if it gets complex they need support rather than criticism. And they have the ability to keep the aeroplanes apart but it might not be particularly tidy and they need that support so that if its not as sweet as it should have been they don't go away with their confidence shot because then they might make a mistake.

171 *R

++ Text units 172-172:

172 I don't know what the actual figures are, but I would say it would be good. The person comes into the team, they know that that team is responsible for them. If the trainees got any sense at all, they know that they can defer to anybody in that team for advice and they know that they have their first point of contact through their QJTI and the team

leader. And there have been situations where there has been conflicts of interest and conflicts of personality and things like that, and they can theoretically, in most cases, resolve it. There's always the problem that an abinitio is concerned about upsetting someone because they might try and do them in and that's something that would happen I guess in any business or company but at least you have that avenue of two way communication whereas before, it was difficult to get started because you really didn't now who was responsible for you. You had a check controller and everybody just did the roster - you didn't have any association and I've generally found if someone is new on the block, they're generally made to feel welcome and a bit of an effort is made to incorporate them into the team and that goes a long way to the team leaders being able to help that person get through. Because the team leader is ultimately responsible for deciding whether or not that person can do the job on their own. They are the check controller - so they need to be fully informed- they want to know if there's a concern in a particular area and whether they can try to fix it. He's the person who can theoretically, when it gets down to it will cause the trainee to say, good, bad indifferent, whatever the case may be and to get their confidence up or be warned that if they don't pull their finger out, they might not see it to the end. That happens all the time. We see just as many failures - no we probably see more successes. But in pat times, we've had a few people just happen to be not quite as good and they have happened to have come together and its been interesting to watch how the system copes with those sort of people who are - almost, but not quite. I mean, if you've got someone who definitely just cannot do it - its not hard. Or if there a whiz kid - though sometimes a kid is bad too - someone who is a solid performer. But when you've got someone who is - almost - almost if - you keep feeling like just give them a bit more and they'll come good - that's a hard one, that's a tough call and tough one for the team leader. really tough

177 *R

++ Text units 178-178:

178 I can give to an example of a girl I know personally on one of the other teams. She battled, She was really struggling with it - she had a conflict with the team leader and I don't think she ever had the courage to actually resolve it, to say 'I can't work with you, I need to be in another team' and I suspect from watching it from the other side, because I only sat with her a couple of times through circumstances down here, that if she'd been in another team, she probably would have made it, because the support mechanism would have been different. She would have felt more comfortable about what she was doing and therefore her confidence would have gone up and II have no doubt that that was the case. I'm pretty confident that if she'd been in another team environment that would have made the difference. She failed in the end. and it got pretty protracted - two or three people checked her - her training was extended - she came down here it was very emotional for her - she got very emotional at times because she felt that she couldn't do it and I think that she got to the stage that any ability she had went out the window because she felt so pressured by the whole situation and that was a really - that's where there is still not the maturity in the system for - the team leader involved - Ann as the stream specialist, possibly Sue - to say this girl needs to be in anther team - because you can't keep bashing her against the wall because we're going to loose this resource. We've spent mega bucks getting her to this stage, let's try everything - lets put her into another team - with a new raining officer and a new team leader and see where we go - at least give it a shot and see if it makes any difference and that avenue was never ever used. And I felt that that was the one that was needed. Because I wasn't in this job then - I mean I could have - as a single person I could have gone up and said this is what I reckon we ought to do but they just as likely would have said nick off.

201 *R

++ Text units 202-202:

202 Absorbing the culture, which we've talked about and getting themselves to the stage where they realise that not everybody is out to get them - Tad Babiak - he was up and sitting with me and Alf and Alf made the observation that a lot of trainees come with the feeling that they're being checked all the time, they're under assessment and its very hard to get away from that and get into this is a learning environment, I don't care if you have conflicts, as long as you're learning from it and to find a balance between those two things for the trainee is difficult. "My God, I missed that!" you know - an the effect that has on their confidence and having the ability to say to them "I don't care if you miss all the conflicts today I want you to recognise when you've got to transfer these aircraft to the new frequencies" Lets not worry about conflicts and then the other way around - lets not worry about the radio and whether you can hear them or not because its a real problem where the VHF outlets are and its a significant part of the training. Because if you lose an international aircraft over Australia off radar, off radio and you don't have the resources to get them back, you've got a real problem - that's as bigger deal in our area as the resolution of separation. So that's a thing - for the trainee to get out of the culture of constantly thinking they're being watching and if they make a mistake. See I came out of one of the courses where we had to get 100%. It was one of the most horrible experiences of my life and I would never want anyone else to go through it and so getting that attitude out of someone is really hard and I'm not sure whether you really ever achieve it. Another thing for a trainee is getting to know what's available to them. The avenues of support - that Sue Key's a busy person but she's available - if you really want to see her she will make time to see you..

222 *R

++ Text units 223-223:

223 Oh, no, but they already has a pretty fair idea of how we were going to go - they recognised that were would go pretty well and it would probably be okay and that helped them I guess with their planning, because, with someone else , they've got to watch them for a while. So I got through the simulator runs reasonably comfortably and the only time when I stuffed up was when - they had some assessed runs at the end and I did miss one conflict right at the end and that was the only time and that felt bad, because up to then, I hadn't made that mistake. On the job- it was about six seeks - on the first five weeks, I felt like I was progressing okay, there was no problems but in the last week- I really hit the wall. I felt like I was making a lot of mistakes, that I wasn't on top of it, lost a lot of confidence and I've been told that that's very very typical.

240 *R

++ Text units 241-241:

241 Yeah and also "I'm rated, you're not and I'm going to show you a thing or two my friend" And I mucked up in the end, I made a mistake. It was bad for me because it knocked my confidence around, here was no support, this guy was "Aren't I clever, I tricked you" sort of thing and it took me a while to realise that I wouldn't have made that mistake if I had of been able to do things in my own sweet time. I mean it wasn't a dangerous mistake, because he knew that it was going to be okay. But he knew that I had not considered a particular thing and he didn't do anything about it. He pushed me and pushed me "c'mon, c'mon" "can he have this level, can he have this level" kind of attitude and in the end I gave it away before fully looking at what I was doing and so, that was happening about that same point in time and so it was very destructive and those sort of people should be - I mean, I didn't, I should have been the one that was counselled then, I mean I needed it but he was the one who definitely needed counselling.

282 *R

++ Text units 299-299:

299 And often the solution you had in your mind was quite right, it might have needed tailoring, he might have said, that ill work fine, go ahead and do that, we might need to talk about it later, or what about this, which is another alternative and might be a bit more efficient in terms of the aircraft. I'd like to think that the more mature QJTI will say oh well, the 737 is going to fly through 102 minutes more than I would have liked but let him do it, its separated, let him run, he or she will get the confidence that he or she can do it and then away from the situation, where you cannot knock their confidence, you can say, that was good, it worked, but, there are alternatives -next time you might find that next time the guy taxys 3 minutes later and what you had might not have worked next time, here are some of the ways to deal with it, because it is never the same,

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+++ ON-LINE DOCUMENT: CAA Int 51n

+++ Retrieval for this document: 5 units out of 129, = 3.9%

25 *R

++ Text units 26-26:

26 Um, I guess its a matter of, you've got to make a judgement, how far to, at what stage do you interrupt their train of thought, when they're busy and they're working, you may want to point out something, but they're just a little too busy to take it in anyway. so perhaps its best to leave it til later - but then, you may want to point something out - something is just about to go wrong - not drastically but they're about to learn a lesson - something is about to happen. And you'd like to point out that what they're doing is going to occur and all of a sudden, yes, there it does in front of them and its sort of reinforced. So its, when do you interrupt, How far you go . I guess its the interaction between the trainee and the instructor. How much do you tell them, how much o you let them know, ride roughshod over them, how much do you ease back. I tend to sit back a far way. One of the things that occurs in the later part of training is your confidence develops. You have gone through all the knowledge development, really you should know just about everything and especially having been down in the training centre here - that would have been practiced and applied, but to - the final leap is a leap of confidence and that's where the QJTI has a lot to do in developing their confidence, consistent with wisdom and encouraging a wise decision, a safe decision.

3 *R

+ Text units 46-46:

6 An example of it not working very well, is when you can't make yourself, the importance of a particular point being understood and the trainee in this case has got predetermined ideas - you can see that. Of how something should happen and its generally that they've picked it up from other controllers, they've overheard it somewhere and they feel that this is the way it should run, in those cases its quite difficult to get them to change. You've got another problem too, because its not only that they've got a preconceived idea, because you could give them this other information an thy could try it, but they're a little bit frightened. And they've got this idea, they've seen it work for someone else and they're going to keep pushing the barrow, and they're not relaxed enough or confident enough in themselves to try this new idea, so that's why I think its important to develop somebody's confidence, as long as they're safe, so that they're willing to try different techniques. What I try to do to overcome these particular ideas, if its a problem ,if I'm still assessing the trainee, is to ask them, what their plans are for a particular situation. And I guess when I'm a trainee with an instructor asking me that, I know that they're a little uncomfortable about what I'm going to do and they want it spelled out, so I guess that's something that everybody does. So you can have a situation explained, that's what they're going to do, they were thinking about doing this or they could do

that. So, its generally, when you have problems explaining yourself, its somebody that under confident for one reason or another.

48 *I

++ Text units 49-49:

49 And the ways of building up that confidence...

51 *R

++ Text units 52-52:

52 That's difficult and its also a little dangerous. I tend to let them have a pretty free reign on the sector - say what they want. I let them get away with quite a lot - so far as phraseologies go, but when it comes to separation, naturally there's a line drawn - you don't allow a breakdown to occur - but I'll allow most other things to occur and ope that's a lesson for them at least they're, I hope that that develops their confidence, so that they haven't had me badgering them, reminding them of dozens of mistakes, I try not to tell them every time they've done something wrong, cause that tends to reduce their confidence. Let them have a run, and if no-body else mentions it, perhaps they'll feel a little bit more confident "I handled that well today" "He wasn't in my ear". The dangerous aspect is they may think that what they're doing is right, so you've still got to pick a couple of the main points, pick a few things each day, that you want improved and you just hope that they don't do everything wrong

98 *R

++ Text units 99-99:

99 Um, I think its good practice, and to be a good controller, you must do that, I would think that there would ne some controllers who don't do that and are very satisfied with their own ability and don't assess, I would think most people do, perhaps not ability. I would tend to take it a little more deeper and a little bit more personally, I find that my own, I explore my own personality in it - so perhaps I look at it in a little more depth than other people do. The job encourages a certain level of arrogance and, ah, self-confidence and "put other people down" type of attitude - if you've got any element of that in you than its encouraged in this atmosphere and so for those people that perhaps aren't arrogant, but, I'm not saying that I'm not arrogant, but I tend to be a little bit more introspective, I find that, at first it was a little discouraging, because at first, there's somebody who's experienced, and I perhaps didn't realise that they were as arrogant as they are for example and you tend to get put downs from the other controllers. There's a terrible culture that goes on in there, you get put down all the time by some, and other people encourage the put down of other controllers. Its really awful and that's why I probably tend to look at myself, just to make sure that I'm on the right track,

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++ ON-LINE DOCUMENT: CAA-18.text only

+++ Retrieval for this document: 1 unit out of 236, = 0.42%

38 *R

++ Text units 39-39:

39 Well in relation to the two questions you started out with, as far as training, I used to try and set the scene and feel free at any time to cut me off, or you've heard all this before or whatever, okay. And so my colleagues . But I've compared air traffic controllers to sports players prior to the introduction of sports medicine. And what is only just happening now is sports medicine and equipment design, is starting to have an impact on their performance. Up to now we've been very individualistic and proud of our skills and developed those skills, and offended/defended(?) new comers against those skills. And assessed people on their ability to perform those skills. But not define them or to concentrate on the equipment on the system that produces them or anything else like that. And so we are a tennis player. Without a racquet. But with a good deal of agility and good deal of design. But we don't know much about sports medicine. We don't talk about stress

management or we're only just starting to. So we're moving from a field where we didn't talk about stress management, we didn't talk about technique in that way. What it was, someone showed you the job, they yelled at you if you did it wrong and you learnt to do it or you failed. And that is very much the attitude now. Even recently a comment was made of what makes an approach controller, because now it's considered to be training directly onto approach instead of being something you do at the end of your air traffic control career. And he said well 15 years air traffic controlling is what takes to make an air traffic, an approach controller. And that is the view of many, that they have not sought to analyse it. They have not sought to work out dependencies. Now that make its very difficult to institute training because no one can tell you what makes an approach controller. What items are important or not. So it has a big impact on training because people don't know what to train or how to train it. The goals aren't identified. Or if they are they're, they lack scientific or engineering or any other factors, formal process of proof or analysis. They are very subjective of things. And the changes are de-skilling yes, but it's more than that. The thing that is most worrying for the air traffic controllers though, they don't how many people can put their finger on it, is that the air traffic controller is very much a game of individual performance and of self confidence. And someone talks about raising that 3 inches and had 3 inches, and you say well it shouldn't have much different you know, it's pretty much the same how it used to be. You know, surely it can't be critical. But if your first serves don't go in and you're now starting to have to play your game on your second shot then you might lose a string of tournaments. Now in a tournament you have the luxury of having an umpire decide the result. In air traffic control, except in the worst cases, you don't have that eye to determine. So what may be your losing streak is matter of fact marginal behaviour in your opinion. So your confidence goes down, your whole stress levels go up and all the other factors go it. And it doesn't matter what you change. Whether it be the size of the racquet head or the weight of the racket or the area of the court or whatever. Because an air traffic controller has essentially found out what things create stress in the system and acts instantaneously to relieve that stress. That is his role. He is not there for long term planning. Long term planning is tools from minutes. It's not book work or anything else like that. One of the bigger shocks came to me when I went back to do project work was that I hadn't written much more than a few sentences by hand in years. Constructing reports and all that sort of thing was foreign to me. It wasn't as difficult as it would be for me some because I'd spent considerable time in programming, so the idea of structure and keeping track of things was still there. But I realised if you took an air traffic controller who'd been that way for years and put them into a classroom, then it's a big shock. The biggest thing he's written is 3 letter call sign(?) or a departure time or something on a scrap of paper to throw away. Assuming that they're not involved in external studies which until recently most air traffic controllers weren't. And it's a critical time of phasing as well. I would think that without any search and this is very easy , that you get into your air traffic controller after doing training, after you've been an air traffic controller a few years and you start to reduce the amount of new jobs you're learning on, so you build up your skill level and you're basically living on those skills. About that time you usually get married, usually get involved in all the things of having kids and starting kids off from school, and all the external activities you may have been involved in, such as external study aren't options for . So therefore you existed as well where you were not engaged in the academic pursuits. And you're only using your skills, in a very refined peculiar manner. So to return you to a traditional classroom or a traditional role of management or of anything requiring report writing skills and all that sort of thing, just simply have not been exercised.

So those skills are at your feet and you're really not aware of it until you're presented with a problem. And because confidence is very important in everything you do as an air traffic controller, then that is very inhibiting in performance.

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+++ ON-LINE DOCUMENT: CAA-33.text

+++ Retrieval for this document: 1 unit out of 444, = 0.23%

297 *I

++ Text units 298-298:

298 So is the culture there very assertive so that my assertiveness will win over someone else's? They're quite specific in terms of certain practices and the way they work in, they're reasonably autonomous in terms of their confidence, in terms of their pay rates and what will work and won't. Any other things about the culture?

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+++ ON-LINE DOCUMENT: CAA-35.text

+++ Retrieval for this document: 5 units out of 360, = 1.4%

131 *R

++ Text units 132-132:

132 I think they lost confidence. I don't know. I've never failed.

137 *R

++ Text units 138-138:

138 It is very easy to shatter someone's confidence. I've seen people cry when something's happened and it's most unusual to see a man cry. And I've very very sorry for them. I mean 2 aircraft hit. It wasn't his fault. But I mean you know you think of the repercussions. Well we never ever think of the repercussions in what we do. I think you try and put that in the back of your mind. It's a hard thing to do. I mean I try not every dream about my job. But when you have instances, you go over and over it. You try and put in the back of your mind. I saw a plane oh probably 15 years ago explode in mid air and I was sitting next to the guy that was doing it. He was just handing over to me and this thing just blew up. Light aircraft going for an altitude record over the Adelaide Hills and watching on radar and there's one little blip going along and then all of a sudden there's all these pieces, just blew up. Because he used a non standard oxygen bottle that had grease on the thread and he did it up and the grease ignited and oxygen environment in the plane, the whole thing just blew up. Yeah. I mean I coped with that but I mean if it had been me I don't know how I would have coped. See I cope with things fairly well. I don't get upset very very often. I bend a lot with a lot of things. But you can really feel for someone when something like that happens. Once you lose your confidence that's the end of you. You've got to be confident.

146 *I

++ Text units 147-147:

147 And that once you do you're starting to lose your confidence?

203 *R

++ Text units 204-204:

204 The information was presented to us in an electronic form on the screen and because we had more electronic information on the screen we could use reduced separation standards and because there was less radio transmissions aircraft could be serviced more efficiently and the pilots were benefiting from the new equipment. Because they were getting a better service. And that's what's going to happen with TAAATS. Because as the service increases, sorry as the, as us as the service provider creates a better service, you can work it out in dollars and cents by the amount of fuel that they'd save. I mean just fuel, wages, whatever. By using electronic means to make our job easier and to perhaps as we get more confidence in the system, reduce the separation standards that we're using, it benefits everyone. Like Australia's a world leader in doing development on separation standards using electronic means. This system that we're doing here is a world first. America's spent I don't know how

many billion dollars and it didn't work.

285 *R

++ Text units 286-286:

286 With suspicion. They won't believe, they won't trust the equipment. They'll try and do it with probably part of the old way of doing it until they get confident in doing it. It'll take them a long time to get confidence in it. If we get vocal groups that are union orientated and that they'll probably put pressure on us to do certain things differently. All the safety issues, affordable safety, all that'll come up, I'm sure. It'll all raise its . I think there's quite a lot of problems that we probably haven't even thought about that'll come up and hopefully we can cover them. It's just completely different the way that we do things. Because we were exposed to this when we were going to have the 11th of November changes. I was the project officer for South Australia and Northern Territory on that, so I was involved in another project for a year, just over a year, and I can see a lot of similarities there through what we're doing here. And I've never been so disappointed in all my life. I spent a year of really hard work and then Dick Smith pulled the pin.

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++ ON-LINE DOCUMENT: Int 106.txt

+++ Retrieval for this document: 5 units out of 56, = 8.9%

++ Text units 6-6:

6 From my own experience, I'm a bit of a confidence man, as a lot of people are, you run on confidence and when you're not given any confidence you drop your bundle a little bit and you sort of kind of think, well, why should I try, everything I'm doing is wrong and that's the way it was with me. I figured, that no matter what I did, I'd always have holes picked in what I did, so I had to get rid of the training officer that I had and I had a new guy who just sort of sat back and let me do it and my confidence picked up and shortly after that I was rated.

++ Text units 14-14:

14 (people who are uncertain may act with bravado, people with confidence openly admit their mistakes)

++ Text units 32-32:

32 Training Officer saps confidence - will send trainee into downhill slide,

++ Text units 36-36:

36 How does an inst build that? He just tells the tr just that. Everybody goes through this phase, keep on working at it, you will come out of it if you keep working at it. I can see that you will come out of it. Don;t relax, but don;t lose your confidence either.

++ Text units 38-38:

38 Well it is, it is a confidence crisis. You begin to doubt yourself, You feel bad, you doubt your ability to do the job and nobody should be doing the job if they doubt their ability to do it, its as simple as that.

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++ ON-LINE DOCUMENT: Int 113.txt

+++ Retrieval for this document: 5 units out of 49, = 10%

++ Text units 4-4:

4 What's the role of confidence?

++ Text units 6-6:

6 I've got one controller who is a real confidence player. If he's down on confidence, we've got to keep a real close eye on him because he's just, so hopeless, we have lots of problems with him. If his confidence is up, not a problem in the world, away he goes. So we have to keep a careful eye on his confidence and how he's going along, when he's training, we have to be very careful. Other people, doesn't really matter, its more to do with their personality in the sense that, somebody could be go at them and they'll just go 'nup, don;t care', but coming up to your check, you really need some confidence, If you've got no confidence you're not going to get through. The TL will be grilling you, asking you questions. And they have to make sure, because they have to be comfortable letting you

go. And if you're not totally comfortable in being able to stand up and say 'I'm in control of the sector, This is my job, you're not going to get through. Sometimes its a case of saying, its just confidence, another week, I'll put him with someone else to build the confidence up.

++ Text units 27-27:

27 fine line between confidence and ego

++ Text units 29-29:

29 It helps with your decision making, because if I've had a rough ride on the sector or I've scared myself, or I've been away and I've come back from leave and you've familed and you've been sitting there for a while and you think, 'ooo, is this the right thing? or 'am I making the right judgement here?' Its all confidence "I am making this" and away you go and the traffic moves a lot easier and even though you might not be making the best decision at the time, because you've been saying 'oh, this is not working, bang, turn him off here' and things work so much easier. If you don't have the confidence you don;t think you're as good and, with the confidence, you don't think 'I'm invincible I'm going to get through this day

++ Text units 31-31:

31 So there's inner confidence and then outer expressions of confidence, because when people aren't inwardly confident, sometimes they have this bravado to pretend that they are?

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+++ ON-LINE DOCUMENT: Int 121.txt

+++ Retrieval for this document: 4 units out of 77, = 5.2%

2 *Int 121 - Instructor Melbourne, enroute

++ Text units 11-11:

11 After being away this time, I was, how would you say, more confident in my own ability to handle it? People say its 99% of what you say and how you say it, not what you know. If you exude confidence, then you will be confident.

++ Text units 13-13:

13 Confidence is the crux of it isn;t it?

++ Text units 15-15:

15 Oh, very much, very much. you've got to be confident in your memory, what you remember, how you approach things, you've got to achieve the pilot's confidence straight away, he doesn't give you a second chance. If you do something and he feels...., like, He's... putting his life in your hands, and if your confidence isn't there, or he doesn't feel it's there, then he's going to be nervous. And that's going to make things more difficult, because he's going to want to know more information, then you're going to get further behind, and it steamrolls itself. So if you're not confident, those around you and those you speak to will hear it and you'll undermine yourself, and your confidence gets worse. Its a difficult time for somebody who's been away, or someone who's had an incident, or who's newly rated, to sound confident. some of the younger trainees (especially, because they sound so young).

++ Text units 21-21:

21 Like the pilots would say "oh yes, and is your dad there as well?" And that will steamroll on itself very badly because they lose confidence in themselves. And there was one trainee who we were having a little bit of a problem with, in that format. She was losing confidence because, her voice didn't inspire confidence. And she wasn't my trainee, she was a friends trainee and he asked me to sit with her for a week. Because he wasn't having ant luck inspiring confidence in her. He was a great fellow and had plenty of time for everybody, but he just wanted somebody else to look in. And to me, that made me feel, better than just your normal controller because, he came to me. I had trained him. And he said I helped him greatly as a trainee and that boosted my confidence no end. It makes you feel good when somebody comes to you like that. And so I went across and I tried to help her out, and I did notice a lot of what he was saying was true. The pilots had questions in their voices.

They were reading back stuff with questions in their voices, and she was hesitating, (she did get a rating in the end, we worked on her) - she just needed the confidence to get it across.

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+++ ON-LINE DOCUMENT: Tape #50n

+++ Retrieval for this document: 1 unit out of 470, = 0.21%

254 *RT

++ Text units 255-255:

255 I feel a lot more tired when I get home from work I am really tired. When I get up of a morning I think about it all the time and then after a couple of days I feel good again. Then I think that I am right on track and feeling good. I have had a couple of good runs and my confidence is up. Confidence is another thing. That's when I feel that I am moving long nicely. As soon as your confidence takes a bit of a dent, it all slows down a bit, but things catch up again. I can't put a handle on it exactly. It is up here (head).

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+++ ON-LINE DOCUMENT: Tape #72n

+++ Retrieval for this document: 8 units out of 711, = 1.1%

196 *I

++ Text units 197-197:

197 What's interesting is in, say a normal six-week period, when I've asked people when the problems have been, (with trainees in general, which is what I am going to ask you in a sec) when it has been difficult has generally been in here. Now that is sometimes I think because some trainers seem to spend the first couple of weeks being really encouraging and building the confidence element and then this is the week where they start telling them the cold hard facts.

214 *I

++ Text units 215-215:

215 That's my sense of it. The reading that you just gave your trainee sounded to me quite frank, specific and registered expectations. This is where you needed to be, this is where you need to be, this is where you are, this is why it is not good enough, and that that is something that I am getting a sense doesn't happen. Maybe it needs to so that then people get to a rating check and lose all confidence because somebody else then has to come in and say "well listen, these things just aren't ...".

304 *I

++ Text units 305-305:

305 That's a means by which you instil confidence in them by grabbing a paper and sort of attempting to do something else.

313 *R

++ Text units 314-314:

314 Basically when you get the trainee and you are trying to help them and they won't be told. They sort of say "No, no, you're wrong". You say "How am I wrong?". They haven't got a good enough excuse but they basically won't be told. They have made this map and they are not willing to think about it or to go over it and try and consider any to her aspects that they may have done it better. They are just confusing that I'm right and you're wrong. There must be something you are doing. It could be a lack of confidence on their behalf. They won't be told because they feel that if they are told they are not progressing properly so therefore I won't let you tell me anything. I'll go bull-at-a-gate and I'm going OK>

373 *R

++ Text units 374-374:

374 I think what it was, he was from Rhodesia. He turned up and told everybody how great he was and then managed to have great difficulty in proving it. Then when it was getting close he just lost all confidence. I think a few people might have been riding him a bit but I just "well you'll be right. Keep going". Just trying the gently, gently, gently approach with him. You could tell it was sort of a big loss of face for

him because he had told everyone how great he was and then of course he couldn't cope.

646 *I

++ Text units 647-647:

647 Part of that's confidence and it has got that double-edged sword.

649 *R

++ Text units 650-650:

650 Yes. You've got to have confidence, but you have not got to think that you are really good. You have always got to think you can do better.

655 *R

++ Text units 656-656:

656 It is pretty hard being a senior instructor up there. We are not in a classroom drawing things on boards. I'm just sitting there watching. There is not much more I can do apart from talking to you about it or anyone else like that. Or stopping you from taking my licence off me. There isn't really much more I can do apart from trying to give you some confidence, stop sitting there behind you in a high chair writing notes, and that's got to give you some sort of confidence. Just to let you go far enough but able to keep you out of getting into too much trouble. There's not much more can be done. I am not going to become a better lecturer or anything like that, or be good in the classroom because that is not the way that it is done. They are just training people up there. It is just sitting there letting them go and trying to see what is going on in their head and if they are starting to do things your way and they are saying the right words that you'd be saying at the same time you'd be saying them, or about that time, then you can settle back and say "right, this person's ready".

+++ ON-LINE DOCUMENT: Tape 46n

+++ Retrieval for this document: 1 unit out of 473, = 0.21%

154 *R

++ Text units 155-155:

155 Yes. We are trying to tell everyone how good they are and at the last minute they suddenly get a shock that no, they are not being very good. It is a hard thing to address because people are trying to build their confidence that are training them, but I think there needs to be a bit more honesty and bluntness, perhaps.

+++ ON-LINE DOCUMENT: Tape 54n

+++ Retrieval for this document: 1 unit out of 421, = 0.24%

119 *R

++ Text units 120-120:

120 Not with my trainees. Probably other people have thought were really switched-on and haven't proceeded through. Probably a good look and say "Maybe a different training officer would have helped a little bit" because you thought they were a bit better than that. Because usually, a lot of the time the team leaders will use the training officers own experience and speak to you and go "It's not the sole decision making process" because he has to be happy about them, but he will come to you and say "How's it going?" and you go "I think he's covering everything basic. he's pretty safe. I have no real problems there. I am sitting back generally with not much input now". He goes "Great, it is looking good" and he will use that probably as a basis to looking at the person. If he looks at you and say "Look, he's really struggling on this" or "He always botches up on this" he will keep his eye on that and maybe look him a bit tighter in that area and maybe ask him a few more questions about that to see if he understands the implications of his actions and so on. Things like that. Sometimes when they have just made a bit of a balls-up, and the checking officer says "Look, I can't pass him because of that", you go "Oh, he hasn't done it before. It is unusual that type of thing there, but these things happen and we all make mistakes. Sometimes it is the pressure of just being a check anyway." -XXXXXXX the

course is that. Just misses something or makes an error. You usually say "Look, I think he's better than that." "No worries there. We'll have a look at him in another couple of weeks. Get him to build up a bit of confidence as well and maybe polish up those areas".

+++++

+++ ON-LINE DOCUMENT: Tape 55n

+++ Retrieval for this document: 1 unit out of 226, = 0.44%

143 *R

++ Text units 144-144:

144 The sticking points for SMC, there is a fair bit to learn about the surface of the airport. Where: all the parking bays are; certain aircraft park; the points of confliction are - the most logical points of confliction and the best way to avoid conflictions is to avoid them all together, but that is a skill to be gained. Where just by turning one aircraft so that his path is behind or sort of so that he will never get in front of the aircraft he is conflicting with obviously is one way to avoid the confliction. That sort of thing. The operation of the equipment, taxi-way names, there is not a great deal of XXXX we have, there is only one frequency that we are dealing with XXXX operation of XXXX. Basically, it is once you are over the hump with the actual physical conditions, the nomenclature of the airport and of the layout, it is really just the judgement, experience, how long does ... because you are the one who determines when the aircraft are going to arrive - the holding point, and in which order. Who takes longer to get ready. Would it be advantageous to stick that aircraft on a different runway? Just being ahead of the game in that respect. You can get an SMC rating probably in three or four weeks without very much trouble, mainly because you mightn't be super efficient by that time, but you are at the stage where you can do it safely and you can learn by yourself from then on. Because it is fairly tightly controlled by the other two people in the tower as to what your actions are. The great and over-riding thou shalt not in SMC is thou shalt not enter or cross a runway XXXX the ADC without asking him. If you don't ever do that then you are not going to go disastrously wrong. You are not even going to get yourself into an irretrievable situation. You might get things snarled up so that everything slows down and stops for a little while while you sort things out and extricate but as I say, it is not dangerous. The worse situation you can have is two aircraft nose-to-nose on the taxi-way because then you know you are going to have to get the tugs out to push them apart because they can't back-up. It has only happened once that I know of here and that was about twenty years ago. That is the worst situation that you are going to have. It is mainly the knowledge that that XXXX. Once you have got your rating it is more ratings in air traffic controller licenses to learn. You get your rating when you are the minimum safe acceptable level. From then on you are expected to improve. An SMC you can be a little bit more ... you can give a rating to a person when he is perhaps at a little lower level in terms of confidence than you would in any other position because of the particular circumstances and the job. Aerodrome control - there is not too much extra in terms of knowing the structure or the infra-structure of the place because you should already be bringing that with you from the SMC. A little bit more knowledge about the runways, the approach aids, runway lights when you should and shouldn't touch the XXXX but aerodrome control is really all experience. It is all judgement and learning. You need to know the SIDS and SRDs which is where the aircraft go when you say "Clear for take-off" you need to know where he is going to go. If you are expecting him to go XXXX it can be embarrassing, but really, it is more just handling the traffic - there is no substitute for it. You have just got to get in there and work and work and work until you skill levels and your judgement actually do come up.

+++++

+++ ON-LINE DOCUMENT: Tape 68n

Appendix 7

Summary of ATC abbreviations used in the course of their work

1	3	4	5	6	7	8	9	12	13
	2				10			11	

Figure 16 An overview of the procedural strip

- BOX 1** Estimates about an aircraft's arrival at/departure from a fix – abbreviation of the fix, estimated time of arrival, estimated time of departure, time intervals to reporting points.
- BOX 2** The actual time the aircraft reports at the fix.
- BOX 3** The time the aircraft transfers (or is due to transfer) to air traffic control.
- BOX 4**
- Details (recorded as time, distance, or both) when the aircraft enters/leaves lateral conflict
 - Details of clearance issued
 - Estimated times of passing
- BOX 5** Details on flight levels or altitudes (recorded in hundreds of feet) – planned level, level(s) for which clearance has been issued or which an aircraft is maintaining, level(s) left.
- BOX 6** Details about the aircraft – type, class of operation, call sign, flight category, flight number, cruising speed.
- BOX 7** Estimated position prior to the fix for which the strips are raised, or on the position after the fix if there is no subsequent strip for that position.
- BOX 8** If box 7 contains the estimate for the prior position, the actual time of arrival for the fix in box 7 and the flight level.
- BOX 9** The actual time when a flight clearance is issued in a CTA.
- BOX 10** Tracking details – departure point, route to be flown, destination, departure time. Recorded in terms of route number, navigation aids, turning points.
- BOX 11** Any other details not contained in previous boxes: clearance limits, holding instructions, level requests, traffic information to be passed, DME distances obtained, coordination prompts.
- BOX 12** Used in a radar environment. We shall not discuss these at all in this module.
- BOX 13**

Symbols and abbreviations

The following standard ATC symbols and abbreviations are the most commonly used in the ATC simulation exercises you will undertake during Phase 2 of your conversion course.








	enter control area
	leave control area
	level as cleared by ATC
	maintaining assigned level
M (level)	maintain initial level (departure instruction)
AL	amended level
AR	amended route
R (level)	reach (level)
x	by
@	at
NB	not before
 (IAS)	climbing indicated airspeed
 (IAS)	cruising indicated airspeed
	to record that an item has been checked, received or transmitted
ELC	entering lateral conflict
LLC	leaving lateral conflict
TP	time of passing

Table 10 **ATC symbols and abbreviations**

To illustrate the nature of ATC work, a typical flight will be described to show how the work is undertaken. Let us assume the reader is a conference goer, and has boarded a domestic flight that will travel between two Australian capital cities. As the reader takes his or her seat, and begins to watch the inflight safety demonstration undertaken by the airline's flight attendants, what is happening behind the scenes?

As a regular public transport flight the airline will have already logged a proposed flight plan, containing details of the flight. It will have done this by computer facsimile to Air Traffic Control. Based on this information, Airways Data Services Officers (ADSO's) have prepared the flight strips (the small paper strips with the aircraft's call sign and proposed tracking details across the various airspace sectors the aircraft is to traverse — see Chapter Five). Multiple copies of these have been prepared for each of the controllers on each sector the aircraft will travel through. As discussed in cross reference, the controllers will use these paper flight strips to note the progress of the flight and as a memory aid.

When ready for departure the pilot requests airways departure clearance. When the clearance is given, this allows the pilot to "push back" from the terminal and proceed to the instructed holding bay, ready for take-off. From the time the aircraft is ready to leave the terminal area and until its wheels lift off the ground, it is the responsibility of air traffic controllers in the Tower. Tower controllers are responsible for the surface movement of an airport. They are also responsible for airspace directly above the airport (e.g., to 3,000 feet); to ensure that light aircraft departing and landing at nearby General Aviation airports do not get in the way of controlled aircraft arriving and departing the main aerodrome.

Three to four controllers with specific responsibilities have been working to get the aircraft to departure. The first controller involved is the person responsible for airways clearance delivery. This controller, having conferred with others in the Tower, advises the pilot of departure procedure, i.e., when to "push back", in which direction to proceed, and which taxi holding bay to proceed to, to be ready for take-off. The airways clearance delivery position is not regarded as a particularly skilful one. It is an important position, however, in that this is the time when flight details are read back and checked and coordinated with tower and Approach controllers.

Once the pilot “pushes back”, the aircraft becomes the responsibility of the Surface Movement Controller (SMC). This person ensures the aircraft proceeds safely to the runway required, using the airport apron and appropriate taxi ways. The surface movement controller exercises control over all of the airport’s surface except for the runways/runway the Aerodrome Controller is using. The SMC rating is also regarded as a junior Tower position, but it is a pivotal one, as the following controller explains.

SMC is your first [Tower] rating. It is a good initial rating. You are not likely to kill anybody. You could, but it is unlikely but you could embarrass yourself to death. It is a pivotal position because what you do as an SMC with your taxiing aircraft can determine how the rest of the system functions. If you get things snarled up on SMC or if you present aircraft in a less than optimal order to the ADC [aerodrome controller] then things will not work nearly as well so it is a complex task. / It is a job that gets very busy and very complex. The potential normally isn't there for things to go disastrously wrong. / The worst situation you can have is two aircraft nose-to-nose on the taxi-way because then you know you are going to have to get the tugs out to push them apart because they can't back-up (Int 54. Controller, Tower Melbourne).

The work requires quick thinking and quick response times.

SMC is different in that aeroplanes come from nowhere. You have no idea who is going to call you next because you are the first link in the chain. You are sitting there, nothing could be happening and all of a sudden fifteen aeroplanes call you in any order. You have no idea what is going to happen next and what they are going to ask for. So from that point of view it is total reflex job. You have really got to have a grip on what is happening where everything is so you can just go bang, bang, bang, bang and change the plot every time one calls (Int 68. Controller, Approach, Brisbane).

The Aerodrome Controller (ADC) exercises authority over the runways he or she is using. This position is regarded as one of the more senior positions in air traffic control. Quick thinking and decision making based on experience and judgement are the hallmarks of the aerodrome controller. As aircraft land and depart, the usual in-flight separation standards do not apply, therefore, separation of aircraft is undertaken visually. Radar separation is not used because the aircraft are too close, although incoming and departing aircraft are

tracked on radar. In terms of landings and departures on the surface of the airport, the separation standard is that one aircraft can be on a runway at any one time. It is the aerodrome controller's responsibility to ensure separation standards are met and that aircraft land and depart expeditiously. The following Tower controller explains some of the expert knowledge that is developed over time and the inter-relationships between Tower and Approach controllers in operating within the aviation system.

You have got the runway there and you have got aircraft waiting to take off and you have got aircraft coming in to land and Approach is feeding you. / The die is cast basically. This one can't land until that [take off] one is off the runway and they can't take off till that [landing] one is off the runway. So you really back your judgement in this job so that you have got to say *'Okay, he's going to take, he'll take about thirty-five seconds to rise'* so that as this one takes his wheels off the ground, this one puts his on the ground down the other end. That is the closest you are allowed to play it. Once you have made that decision to line this aircraft up, there is nothing you can do about it. You have just got to sit with it, hope that everybody does the right thing and it fits. In every other position of air traffic controller, if you make a mis-judgement (and we are only humans, we all make mis-judgements from time-to-time) you can usually fix it just by working a bit harder - widen someone out and tightening someone in, do something else with them. If you make a slight error of judgement, you can fix it. You can work hard - you might have to accelerate for two or three minutes to get it all back on the rails. Here you can't. You make that decision, make that judgement and you go with it and you have just got to sit there and wait for it to happen (Int 54. Controller, Tower, Melbourne).

Sometimes simultaneous operations are undertaken on the same runway. "Simops" is a practice where one runway is treated as two halves. Another controller explains the impact this has on Tower work.

You can see that gets busy because suddenly we have got two arrival streams. You are looking at two directions plus you have got departures here. You might have a departure off there plus we quite often get the 'rats and mice' [term for light aircraft] out of Essendon [nearby general aviation airport] coming up over the top. Someone might be coming up over the top at two or two-and-a-half thousand feet so whilst you have got to keep an eye on them to make sure they are not going to get in the

way of a possible Approach or either of the other runways or a departure (Int 55. Trainee, Tower, Melbourne).

The third position in the tower is the co-ordinator position. This controller co-ordinates various pieces of information to and from the tower with others working in the aviation system. It is regarded as a position that is fairly straight-forward most of the time, except when there are weather changes as described below, the person in this position plays a key coordination role.

The time that it gets busy is if the weather turns bad - thunderstorms, low cloud, frontal activity where you are constantly talking to other people and you have got to be constantly on their word that you might have to change runway direction from one to another and keep everybody informed. It is a job that relies more on diligence and experience than it does specifically to traffic management. He is also an extra pair of eyes for the SMC and the ADC (Int 55. Trainee, Tower, Melbourne).

Getting an aircraft ready to depart and airborne requires collaboration between the Tower controller and the relevant Approach controller. Although the aerodrome controller in the Tower is responsible for lining the aircraft up on the runway and instructing the aircraft to take off, once the aircraft is airborne, it becomes the responsibility of the relevant Approach controller to ensure the aircraft successfully negotiates its way through inbound and other outbound traffic to reach its planned flight path. Within the Area Control Centre, "Approach control" provides an air traffic service to departing and arriving aircraft in the establishment of the flight course and initial phases of climb (within 30 miles of the aerodrome), as well as to aircraft in the final descent phase of flight. In contrast with the earlier transcripts of Tower controllers, the following summarises the views of an Approach controller. From the transcript the intensity of the work and its interdependence with others is evident.

Approach is work load management. There is nothing complex about it, you have just got to do a million things at once so it is work load management. You have got to be able to control your workload. Being able to say *'No, I am not going to launch another one, they stay on the ground till I am ready'* is controlling your work load. That is one of the more extreme ways but safety comes first. You get to the point that you are starting to think *'I don't want any more'*. You can say

'Nothing for you' and then they [controllers in the tower] might come back in a minute or two. Other times you say *'Nothing for you until I come back to you, finish. Don't annoy me'*. That's it and they get the message. That is when you hear the bell behind ring as they ring the boss and say *'What's he doing?'*. You can bet on it. Your instincts are there because you are used to doing ten things at once, if you say *'Nothing for you, don't annoy me'*, you are listening for the bell behind you. There is a distraction straight away (Int 68. Controller, Approach, Brisbane).

The quote above illustrates the systemic nature of the work and how the work involves time pressure. The planned aircraft departures and arrivals require aircraft to be moving as quickly as possible, so that airline schedules are met. The management of air traffic is sometimes under pressure because individual controllers do not always appreciate the interdependent nature of the work and the task demands on others. The following excerpt illustrates the interdependence of work undertaken between Approach and the Tower and the influence of the rapidity of work within both sectors.

Some of the guys we have got up there (in the tower), they have lightning fast minds. The problem they get into is they are too fast for some of the guys here [on Approach] and they get away with it. You have got to learn *'him I can trust, him I can't'*. If he says we will do it that way, you do it. By the time you have done it you look at it and say *'I got what he is on about'*. Away you go with it. the problem most tower controllers have is they will focus mainly on the immediate tower air space whereas the Approach controller is looking at thirty miles (or at least inside twenty miles), at the whole thing. A problem that is out at ten miles, the tower bloke doesn't see / It is not his job, it is not his area and they probably need If you talk to some of the guys who have worked the combined rosters where they have worked tower and Approach combined, they reckon it works really well because you are used to looking at the whole picture and it is just natural that you do (Int 68. Controller, Approach, Brisbane).

Tower and Approach controllers are regarded as the most senior positions in air traffic control. Tower work requires a lot of experience and quick reactions and Approach is perceived to be one of the hardest jobs and (thus historically at least) has been accorded the most respect. Under the old organisational structure, Approach controllers were paid the most money in recognition of the task demands.

All the people in the tower ... the average age of the controllers in the tower is probably about 45 or 46 so they are much (generally speaking) more reliable sort of people. They have been around and they are not likely to be caught out by the little traps and so forth so it is not such an arduous task. / tower is one of the later positions that you did. Like Approach is now. The tower is also a place where controllers have gone when they haven't done Approach control. When they have become senior and they have tried to do Approach and haven't achieved the rating or they have declined to do Approach because Approach is the hardest job of all at the moment. It has always been where the more senior people tend to gravitate up and rise (Int 55., Trainee, Tower, Melbourne)

The aircraft has negotiated its way along the taxi ways and has successfully departed the airport. The pilot has been directed by controllers working in the Approach/Departures cell, and has commenced its climb to achieve the desired flight level and flight track. The aircraft is enroute to its destination. The pilot has most likely been given instructions to climb and reach a certain level by a certain navigation point and has been instructed to call a particular frequency when this occurs. (To reach Enroute airspace, the aircraft has traversed another type of sector, called "inners" or Arrivals - see the geographical airspace Figure in Chapter Five). The "Enroute" controller now responsible for the aircraft when the pilot calls, monitors the aircraft along its flight path, checking speed and flight level details and checking for any potential conflicts with other aircraft using or crossing the planned flight track. Given that Enroute sectors are larger than others (see Figure x cross reference because they are less complex, there are many crossing tracks and many permutations to be calculated.

Enroute control is regarded as a junior controller position and at the time of this investigation (i.e., prior to the introduction of streaming, see Chapter Five) the first rating a controller receives will be an Enroute rating. When an aircraft reaches an Enroute airspace, it is most likely on climb to its proposed flight track, the airspace is larger and the potential problems can be anticipated over a greater time frame than is possible in Arrivals, Approach, or tower control. The following controller describes the kind of decision making processes that Enroute controllers will need to make and the time periods that are generally available to them.

You might pick him up and he is already on climb, you might have a separation from him handed off to you with two aircraft on parallel tracks and all you can do is

monitor and make sure they don't get too close until they are moved and separated and are back on track and so forth. You might have to monitor for three or four hundred miles, even longer with some of our bigger operative sectors. Take the position reports and so forth, plan your ... you can see the composites occurring up the track fifteen or twenty minutes ahead. Perhaps even longer than that. So you work out how you are going to resolve this. *'Oh yes, we've got two crossing at the same level here in the next ten minutes, so I am going to need to change it. If I change it what is happening now? Oh, I have to do something about it'*. This sort of thing A lot of planning to be done (Int 55. Trainee, Tower, Melbourne).

The comment above, by a Tower controller, would tend to indicate that the job is easy and perhaps compared to tower or Approach it is. However, the job still involves a lot of work, particularly for the inexperienced. Like all positions, the Enroute controller also works in with the pilot to assist the controller in undertaking the work. Newly rated controllers have to develop strategies to priorities their workload. In the next excerpt, the controller is discussing the safety assurance mechanisms trainees need to put into place so that they are not simply relying on their own "body clocks" - to remind them when action needs to be taken.

When you're an efficient controller, you're experienced, you can rely on yourself and the mental clock to go on to think *'he's about 10 minutes out'*, check the DME distance [navigational distance measuring equipment] and check the estimate, *'yes that's fine'*. But when you're new in the job and if you're under pressure, you need to have safeguards, this separation assurance that's talked about. You need to get the pilot to help you, even unknowingly, so by assigning in this example, an interim level, the pilot will help you with an estimate of that destination if you're busy, if you've got stuff going out everywhere, and you assign that level, the pilot will come back *'I'm Approaching ...'* and they'll often even give you the DME distance and its all fixed, [then you can] assign them down to the minimum and it's gone (Int 51. Controller, Enroute, Melbourne).

In "Enroute control" the physical size of a sector will normally depend on the traffic density in that area. An area that encounters heavy traffic loads will normally be split up into smaller sectors to reduce traffic workloads and to allow safe and efficient processing of traffic.

The aircraft may travel through a number of airspace sectors enroute to its destination. These controllers may be operating from one Centre or may be located at different Centres in different cities (e.g., Melbourne, Brisbane). When the aircraft gets closer to its destination the becomes the responsibility of a controller operating the Arrivals sector. The sector of Arrivals is positioned between Enroute and Approach and assist Approach controllers in sequencing aircraft ready for landing. Arrivals control establishes the landing sequence of aircraft during their initial descent to aerodromes that have regulated air traffic. This may result in an aircraft being required to “hold position” around a certain reporting point. This generally means the aircraft completes a 360 degree circle until it can be fitted into the landing sequence. Advice has been most likely have received from the “flow” (a senior controller who scans all the traffic around a particular Centre and instructs controllers at en-route and Arrivals sectors to place incoming aircraft in a certain order to set up in the most expeditious arrival pattern). At major airports (e.g., Brisbane, Sydney and Melbourne) a new traffic management procedure has been introduced called “STARS” (Standard Air Route Sequencing). This procedure means that aircraft are set up on standard arrival routes for landing (i.e., the aircraft must be at a certain height and speed by reaching a certain geographical point and that only certain runway configurations are available for use). Preparation for landing on standard routes occurs in Arrivals and there needs to be collaboration between the Arrivals controller and the Approach controller to ensure smooth air traffic flow. The following excerpt reveals the interdependent nature of the work between Arrivals and Approach.

We [Arrivals] have to do a bit of fine-tuning with them / Likewise you could hand [the aircraft] off [to Approach] saying “This is it. Five miles and he’s closing.....” and the [Approach controller] goes “Well, why didn’t you just tweak him a little bit beforehand? Just take him off track a couple of miles” because then you would have handed him off eight miles apart and the two would have come down there together [at the appropriate separation standard of three miles] (Int 56. Controller, Arrivals, Melbourne).

Landing on a standard air route does not always occur however. Five to six minutes prior to landing the pilot is communicating with the Approach controller who is responsible for ensuring the aircraft lands safely, as the following controller explains.

He might be coming on to screen and wants to land at [the destination], but he can't go straight to it. He has got to be taken around and put on to an Approach which

means you take over his navigation point all the time. You navigate far more of the aircraft. You move him around. There is far more having to make sure that he is there at a point at the exact time. The next one is exactly the right distance behind. It is a much higher concentration level from the point of view of, you never go more than 30 seconds without looking at every aircraft. You are constantly re-assessing the situation. Whereas in Enroute you can go five or ten minutes because you know he's just cruising along, unless he says something has gone wrong, there is nothing to worry about (Int 68. Controller, Approach, Brisbane)

The aircraft lands and under the responsibility of the Tower controller, is directed to the appropriate landing bay where the conference goer, having watched the inflight movie and partaken of a meal of average quality, collects his or her baggage and continues on with life.

Appendix 9

**Evaluation check sheet used in assessing ATC competence
(as used during the data collection phase)**

Proforma 3



Civil Aviation Authority
AUSTRALIA

SESSION FEEDBACK FORM

OJT ☐
SIM ☐

Trainee:	Instructor/ Training Officer:	Sector: Exercise:	Date:
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Today's Topics / Reviews:

Exercise Observations:

(Points arising from simulator / on-the-job observation)

Recommendations:

(Agreed goal achieving areas)

Trainee Comment:

(Trainee's thoughts on session)

(PTO for further Observations, Recommendations or Comment)

- | | | | |
|--|---|---------------------------------------|---|
| <input type="checkbox"/> A lot more work
required | <input type="checkbox"/> Extra work
required | <input type="checkbox"/> Working well | <input type="checkbox"/> Working above
expectation |
|--|---|---------------------------------------|---|

Proforma 4



Training Assessment Debrief Form

Week:
Milestone:

Trainee:	Instructor/ Training Officer:	Position:	Date:
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Conflict Recognition

F 1 2 3 4 5

Strip placement

Assessing pending traffic

Interaction of active traffic

Change of standards (DME, RNAV, etc.)

Separation Assurance

F 1 2 3 4 5

Vertical separation

Identifies options

Lateral separation

Selects best option

Longitudinal separation

Calculation of lateral separation

Workload and Traffic Management

F 1 2 3 4 5

Takes position reports

Aware of pending traffic

Uses defensive techniques when overloaded

Sufficient speed

Applies correct priorities

Knows/applies operating characteristics of aircraft operating in Aust.

Assigns timely descent

Monitors SAR times

Displays knowledge of wx effect on acft. performance

Minimises callbacks

Coordination

F 1 2 3 4 5

Correct coordination for unusual traffic

Coordination completed in time

Traffic Planning			F 1 2 3 4 5				
Pending departures Knows acft. performance Pending OCTA departures	Identifies conflicting tracks Sequences Knows common frequencies	Opposite direction passing Anticipates next action					
Radar Technique			F 1 2 3 4 5				
Identification / verification Radar separation Vector termination	Establishes procedural separation Position reports / amended estimates Radar failure procedures						
IFER			F 1 2 3 4 5				
Appropriate phase on time	Priority to SAR situation						
Stripwork			F 1 2 3 4 5				
Position reports Clearance issue Tick readbacks	Strip annotation whilst talking Calculates and annotates SAR times Clarity and accuracy	Coordination prompts					
Phraseology and Communication			F 1 2 3 4 5				
Uses standard phraseology Uses standby / call-back Uses key words to initiate call	Clear concise delivery Confident delivery, ad-libs well No pauses or inflections						

Documents, Procedures and Airspace Knowledge		F 1 2 3 4 5				
MATS / MATS Supp / LOI Restricted areas		Lateral and vertical limits Radar map				
Equipment Handling		F 1 2 3 4 5				
Manages interruptions ADU setup / console familiarity		Intercom and a/g management				
Handover / Takeover		F 1 2 3 4 5				
Traffic disposition NOTAMS / weather / airspace		Equipment / frequencies Outstanding items				
Teamwork						
Communication with partner						
Cooperation / teamwork						
Trainee Comments						
Training Officer Comments						

Areas identified as requiring more work

Action plan for remedial training

**Trainee's
Signature**

**Training Officer's
Signature**

(This signifies agreement with the remedial program by both parties.)

Instructions for using this form:

- This form is to be filled out:
 - at the end of each week of training
 - at the Simulator Course completion milestone (Milestone 2)
 - and – at the Progress Check milestone (Milestone 3).

For Weekly Assessments:

- Each of the key competency strands shall be graded from 1 – 5 for weekly assessments. The 'F' grading is not required for these assessments.
- A grading of 3 – 5 shall be considered satisfactory
A grading of 1 or 2 shall be considered unsatisfactory and a remedial action plan shall be implemented

For Milestone Assessments:

- The 'F' grading shall be used (if necessary) in assessments at Milestone stages. During a Milestone stage assessment, an 'F' grading shall be used in lieu of a grading of 1 or 2, and shall indicate that a formal remedial plan is required.
- A grading of 3 – 5 shall be considered a pass
(*noted key competencies require a grading of 5 for a pass*)
A grading of 'F' shall be considered as failure and shall instigate a remedial action plan. After the remedial action and following a second assessment, failure may result in recommendation for termination.

Competency Areas: Grading Criteria

Introduction	The Grading Levels will be further clarified by the Educational Specialist.
Conflict Recognition	This assesses the trainee's ability to recognise potential conflicts given various traffic configurations. The trainee must recognise conflicts during strip placement in the Flight Progress Board, from pending traffic and knowledge of the effect it will have on active traffic, and from the interaction of active traffic.
Grading	<ol style="list-style-type: none">1 Failed to recognise conflicts, leading to major breakdowns.3 Recognised ALL conflicts, but was sometimes rushed in that recognition causing difficulties in the consequent resolution.5 Recognised ALL conflicts, the early recognition of which allowed for efficient and safe resolutions at all times.
Separation Assurance	The trainee must possess the ability to identify options for separation that can be safely applied and are appropriate to the situation presented. The trainee must have knowledge of all applicable separation standards - departure standards, longitudinal time and distance standards, lateral separation, vertical separation, and area navigation standards. The trainee must be able to calculate times of entry to and exit from areas of conflict, and times of passing.
Grading	<ol style="list-style-type: none">1 Rarely produced safe solutions, leading to major breakdowns of separation.3 Produced SAFE solutions to ALL conflicts but did not always select the most effective and time efficient solution.5 Produced SAFE solutions to ALL conflicts by considering the options early and then selecting the most appropriate alternative that provided separation assurance.
Traffic Handling and Workload Management	The trainee must demonstrate the application of a logical work plan based on current and incoming information, so that tasks are prioritised and completed in a manner so as to minimise workload, delays to aircraft, and delays to other units. This work plan must incorporate task prioritisation, decision making and implementation, plan revision and teamwork. The trainee should be able to demonstrate a recognition of the need to adapt workload management techniques, and display the ability to adapt these techniques as required to cope with changing traffic density and/or complexity.
Grading	<ol style="list-style-type: none">1 The trainee was unable to process information in such a way so as to manage workload or avoid delays. The work method was haphazard, leading to significant difficulties in decision making or prioritising. Work rate was too slow and little ability to adjust to increasing work rate was evident.3 The trainee demonstrated an ability to process information correctly, prioritise tasks, and implement a plan to minimise workload and delays. Any difficulties were due to problems in adequately adjusting work rate or methods to cope with increasing workload or complexity.5 The trainee was, at all times, able to adjust methodology and work rate to cope with workload demands and avoid any delays. Prioritisation, decision implementation, and task completion were carried out so as to maximise planning time.

Continued on next page

Competency Areas: Grading Criteria, continued

Coordination	The trainee must ensure that all coordination for routine traffic is completed accurately within the correct time. The trainee must be able to determine correct coordination requirements for non-routine operations involving irregular flights, diversions and emergency or abnormal operations. The trainee must use key words to initiate coordination.
Grading	<ol style="list-style-type: none">1 Frequent errors were made including excessive information, omissions, incorrect information, inappropriate or ambiguous phraseology, and late coordination.3 Coordinated ALL routine traffic correctly and on time. Non-routine traffic was coordinated, but was not done in the most time efficient and non-ambiguous manner.5 ALL coordination was correct and completed on time, without any ambiguity or misunderstanding.
Traffic Planning	This assesses the trainee's ability to use all available data to anticipate the actions required in order to process various traffic patterns including - pending departures sequence, pending arriving sequence, crossing traffic, opposite direction traffic, and aircraft entering from OCTA. The trainee must be able to identify conflicting tracks, and be able to identify future work and problems. The trainee must demonstrate a thorough knowledge of aircraft performance.
Grading	<ol style="list-style-type: none">1 Unprepared for simple and probable changes in traffic patterns. No methodical approach to planning was demonstrated.3 Planned ahead and adopted a methodical approach to various situations presented, however failure to consider all options resulted in a higher than necessary workload.5 All situations were planned in advance and alternatives considered. Traffic predictions and strategies were continuously reviewed and amended as necessary, in adequate time for efficient implementation.
Radar Technique	The trainee must be able to correctly identify aircraft and verify level readouts, be able to correctly apply the radar separation standards, and vector aircraft and terminate vectors correctly. The trainee must be able to establish procedural separation in the event of radar failure. The trainee must be able to correctly vector aircraft for sequencing.
Grading	<ol style="list-style-type: none">1 Poor identification/verification and/or vectoring techniques. Did not use radar to improve traffic flow or resolve problems.3 No errors in identification and verification procedures. Little use of radar was made to actually facilitate and expedite traffic.5 Radar used to maximum potential to facilitate and enhance traffic flow. Potential problems were anticipated early and dealt with efficiently. Effective vectoring.

Continued on next page

Competency Areas - Grading Criteria, continued

SAR Actions

The trainee must calculate and annotate SARtimes correctly and initiate communication checks within the required time. The trainee must declare the appropriate phase for the given circumstance within the required time by an appropriate phase declaration method, and complete tasks in the correct priority associated with the emergency.

Grading

- 1 Failed to respond to abnormal situations. Failed to monitor SARtimes and communication checks were not performed in the required time.
 - 3 SARtimes were continuously monitored to ensure that communication checks were carried out on time. A correct initial response to SAR/abnormal situations, however there was insufficient investigation of the events.
 - 5 Correct priority was given to SAR/abnormal situations, reacting quickly and analysing all aspects of the situation with consequent correct responses. SARtimes were at all times maintained with 100% accuracy.
-

Stripwork

The trainee must maintain an accurate and legible display at all times and must annotate strips correctly whilst both listening and talking. Must be able to check strips for accuracy before placement into the flight progress board. The trainee must integrate strips into the flight progress board as soon as possible and remove obsolete strips promptly.

Grading

- 1 Did not maintain a functional and effective display.
 - 3 Display was accurate, clear and generally up-to-date with only minor errors. Did not base instructions to aircraft on incorrectly displayed information.
 - 5 At all times display was accurate, updated promptly, and all information was clear and unambiguous. Stripwork was performed in an expeditious manner.
-

Phraseology & Communication

The trainee must use standard phrases as applicable and be able to use non-standard phrases in unusual situations with the intended meaning communicated. The trainee must be able to use clear and correct speech without pregnant pauses, inappropriate inflections or emphasis, or clipped transmissions.

Grading

- 1 Poor or incorrect use of standard phraseology, resulting in indistinct and hesitant delivery.
 - 3 Standard phraseology used effectively with only minor errors. A basic ability was as demonstrated with non-standard phraseology, however exaggerated transmissions resulted. Delivery was usually clear and concise.
 - 5 Use of standard phraseology was automatic and non-standard phraseology was effectively used, resulting in clear, unambiguous delivery at all times.
-

Continued on next page

Competency Areas - Grading Criteria, continued

Equipment Handling

The trainee must be able to use all interconsole communication channels effectively, manage interruptions and receive multiple inputs from both intercom and air-ground facilities. Must be able to determine correct priorities in answering calls and be able to use the backup systems in the event of equipment failure. The trainee must be able to competently manipulate the equipment applicable to the operating position.

Grading

- 1 Unable to use equipment effectively.
 - 3 Demonstrated rudimentary use of the equipment.
 - 5 Sound understanding and optimum use of equipment at all times.
-

Airspace Knowledge

The trainee must be able to demonstrate a knowledge of the airspace appropriate to their position including - the lateral and vertical limits and the CTA steps, the location of primary navigation aids, restricted airspace, and the adjacent units.

Grading

- 1 Lack of knowledge of airspace and facilities affected performance. Constant referral to maps for even the most basic of detail.
 - 3 Sufficient knowledge to perform satisfactorily. Intimate detail was lacking, hampering performance during complex and busier situations.
 - 5 A thorough knowledge of all aspects of, and facilities contained within the airspace was demonstrated.
-

Appendix 10

**Guidelines associated with on-the-job training
(as used during the data collection phase)**

Draft

Final Field Training Model

**SDO ATS
Training Centre**

Amendment List 1

Checklist of Current Pages May 1995

0 - 1 May 1995
0 - 2 May 1995
0 - 3 May 1995

1 - 1 May 1995
1 - 2 May 1995
1 - 3 May 1995

2 - 1 May 1995

3 - 1 May 1995
3 - 2 May 1995

4 - 1 May 1995
4 - 2 May 1995
4 - 3 May 1995

5 - 1 May 1995
5 - 2 May 1995
5 - 3 May 1995

6 - 1 May 1995
6 - 2 May 1995

7 - 1 May 1995

8 - 1 May 1995
8 - 2 May 1995
8 - 3 May 1995
8 - 4 May 1995

9 - 1 May 1995

11 - 1 May 1995
11 - 2 May 1995
11 - 3 May 1995
11 - 4 May 1995
11 - 5 May 1995
11 - 6 May 1995
11 - 7 May 1995
11 - 8 May 1995
11 - 9 May 1995
11 - 10 May 1995

12 - 1 May 1995
12 - 2 May 1995
12 - 3 May 1995

Amendment List 1

Checklist of Current Pages May 1995

0 - 1 May 1995
0 - 2 May 1995
0 - 3 May 1995

1 - 1 May 1995
1 - 2 May 1995

2 - 1 May 1995
2 - 2 May 1995
2 - 3 May 1995
2 - 4 May 1995
2 - 5 May 1995

3 - 1 May 1995
3 - 2 May 1995

4 - 1 May 1995
4 - 2 May 1995
4 - 3 May 1995

5 - 1 May 1995
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5 - 3 May 1995
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6 - 1 May 1995
6 - 2 May 1995

7 - 1 May 1995

8 - 1 May 1995
8 - 2 May 1995
8 - 3 May 1995
8 - 4 May 1995

9 - 1 May 1995

10 - 1 May 1995
10 - 2 May 1995
10 - 3 May 1995

11 - 1 May 1995
11 - 2 May 1995
11 - 3 May 1995
11 - 4 May 1995
11 - 5 May 1995
11 - 6 May 1995
11 - 7 May 1995
11 - 8 May 1995
11 - 9 May 1995
11 - 10 May 1995

12 - 1 May 1995
12 - 2 May 1995
12 - 3 May 1995

Contents

Training Model Overview.....	1 – 1
The Role of the Training Centre	1 – 2
The Duties of Shift Supervisors and Instructors	2 – 1
The Duties of Target Generating Officers and the Educational Specialist.....	2 – 2
The Duties of Team Leader, Team Training Specialist and the On The Job Training Instructor	2 – 3
Training Duties Diagram.....	2 – 4
Lines of Communication Diagram	2 – 5
The Generic Training Course Structure	3 – 1
Generic Training Course Process.....	3 – 2
The Orientation Phase	4 – 1
The Core Phase.....	5 – 1
The Rating Phase	6 – 1
Ongoing Skill Enhancement.....	7 – 1
Competency Areas: Grading Criteria	8 – 1
Course Evaluation.....	9 – 1
Checklist for OJTI's Developing Training Courses	10 – 1

The Role of the Training Centre

Role	<p>To define and maintain the required standard of ATC training within the SDO.</p> <p>For an overall view of the Training Centre refer to the "Systems View" on the following page.</p>
How This Will Be Achieved	<p>The role of the Training Centre will be achieved by meeting the following responsibilities :</p> <ul style="list-style-type: none">• Provision of the facilities and training expertise to assist ATC teams in the development and delivery of quality training packages,• Provision of training of ATC personnel in the development and delivery of on-the-job training.• Identifying and ensuring the delivery of core training material.• Monitoring and developing the performance of OJTIs.• The constant monitoring, evaluation and improvement of training practices and procedures.• Monitoring the training of each trainee, assisting in identifying areas requiring remedial training and, with the trainee and training officer, developing remedial training strategies.• Maintaining a record of all training material.• Maintaining a record of the progress of ATC trainees within the SDO.
Who is Responsible	<p>The ATS Specialist Support Training, and Simulator Shift Supervisors shall be responsible for the above by proper utilisation and supervision of TGO staff and other resources.</p>

The Duties of Shift Supervisors and Instructors

Shift Supervisor Duties

The simulator Shift Supervisor shall be responsible for:

- the day to day running of the simulator
 - delegation of TGO duties
 - administration duties for simulator shift staff
 - day sheet completion and Lattice entry for all Training centre staff
 - ensuring simulator exercise data is updated to meet new procedures and airspace changes
 - ensuring simulator equipment is in running order
 - liaising with technicians
 - maintenance and ordering of stores.
-

A.T.C. Instructor (Development) Duties

The instructional staff shall be familiar with the functions of one or more ATC positions and shall be required to monitor the preparation and update of instructional material, and delivery of instruction for those positions

The instructor staff shall be responsible for:

- the provision of training of ATC personnel in the development and delivery of on-the-job training,
 - identifying and ensuring the delivery of core training material,
 - monitoring and developing the performance of OJTIs,
 - the constant monitoring,, evaluation and improvement of training practices and procedures,
 - monitoring the training of each trainee, assisting in identifying areas requiring remedial training and, with the trainee and training officer, developing remedial training strategies,
 - maintaining a record of all training material,
 - maintaining a record of the progress of ATC trainees within the SDO.
-

The Duties of Target Generating Officers and the Educational Specialist

Target Generating Officer Duties

The Target Generating Officers shall be responsible for :

- the provision of target generation services
 - exercise development under the direction of the Simulator Shift Supervisor or the ATC Instructor (Development)
-

Educational Specialist Duties

The educational specialist shall be responsible for:

- trainer development
 - course core structure
 - trainer / trainee assistance
 - setting assessment standards
-

The Duties of Team Leader, Team Training Specialist and the On The Job Training Instructor

Team Leader Duties

The Team Leader shall be responsible for

- the allocation of trainees to OJTIs
- liaison with DOSST and Simulator Shift Supervisors
- monitoring trainee progression
- trainee assessment
- quality and consistency of OJT.

Team Training Specialist Duties

The team Training Specialist shall be responsible for:

- the identification of core training material
- ensuring the currency of training material
- provision of support to OJTIs
- monitoring OJTI performance.
- liaison with Training Centre staff.

On The Job Training Instructor Duties

The On the Job Training Instructor shall be responsible for:

- delivery of course material
 - trainee assessment
 - reporting to Team Leaders and TTS on course deficiencies and trainee progress
-

Training Duties

AACC

Team Leader

- allocate Trainee to OJTI
- monitor Trainee progression
- Trainee Assessment
- monitor OJTI quality

Team Training Specialist (FPC)

- identify core training material
- ensure material currency
- Trainee Assessment
- support & monitor OJTI

Designated OJTIs

- mentor Trainees during Orientation phase
- deliver course material
- ensure material currency
- Trainee Assessment

Training Centre

Support Specialist Training (Simulator Manager)

- resource planning & management
- monitor Simulator effectiveness
- monitor Trainee progress
- assist HR manager as directed
- coordinate training strategies

Shift Supervisor

- day to day resource management
- monitor Simulator effectiveness
- monitor Trainee progress
- assist OJTIs
- ensure quality systems

ATC Training Specialist (Development & Support)

- produce core training material
- exercise development
- assist Shift Supervisor documentation
- deliver generic courses
- deliver skill workshops
- ensure standard of course
- ensure quality systems

Target Generator Officers

- assist Shift Supervisor and Training Specialist as directed
- exercise development
- target generation

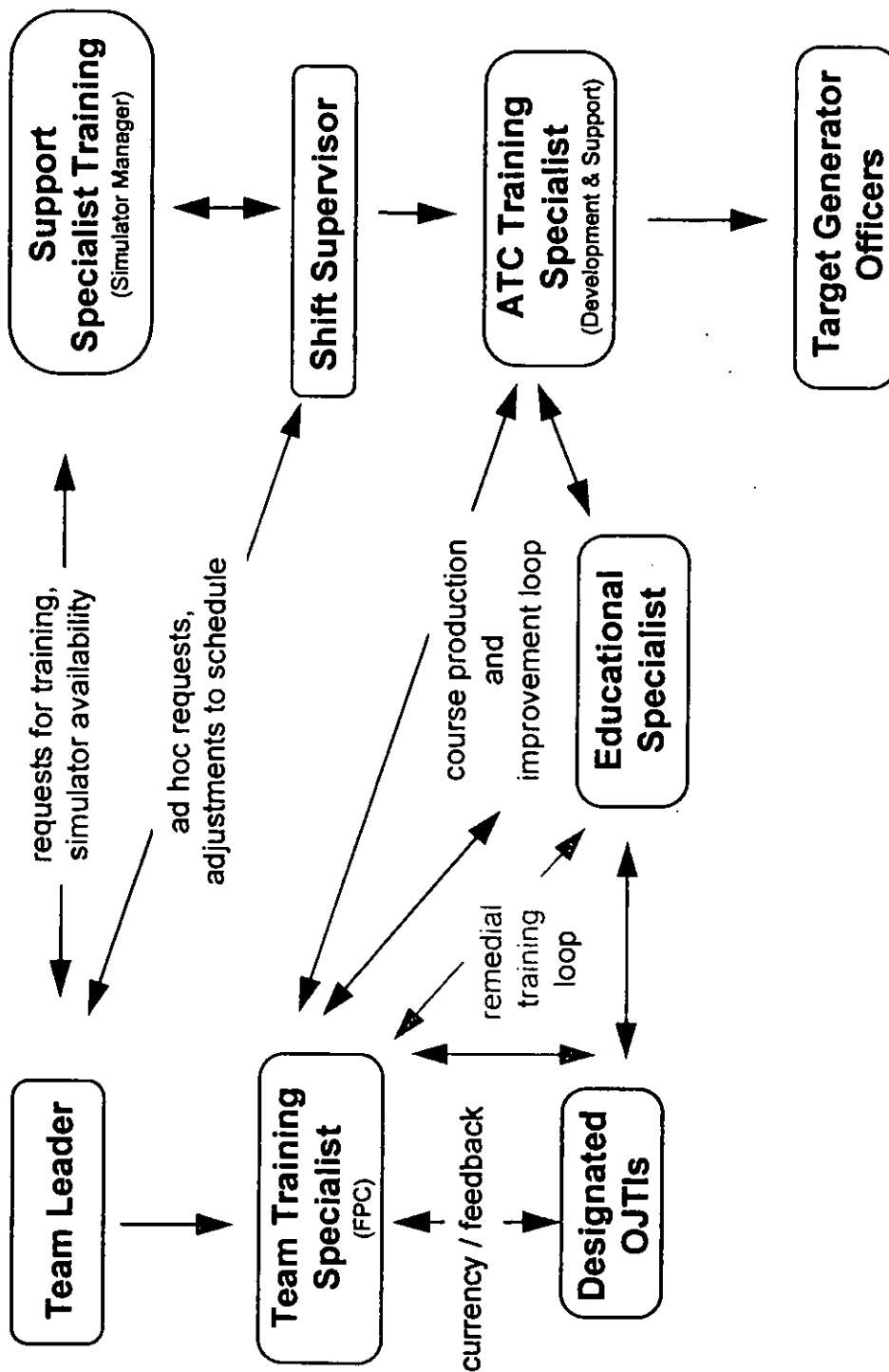
Educational Specialist

- institute Trainer development program
- deliver Trainer development program (including OJTI)
- define course core structure
- Trainer / Trainee assistance
- define assessment standards

Lines of Communication

AACC

Training Centre



The Generic Training Course Structure

Introduction

A Generic structure has been chosen so that a consistent and standardised approach to training can be used across the ATC system. This model requires a large amount of self-directed learning which will make the best use of human resources.

It is intended to keep the operational documentation held in the Training Centre to a minimum, in order to minimise the possibility of the training material going out of date. This is consistent with students being responsible for their own research. Up-to-date operational documentation information is always available in the AACC.

The Generic Training Course is composed of the following :

- ☐ Orientation Phase
- ☐ Core Phase
- ☐ Rating Phase
- ☐ Ongoing Skill Enhancement

With FPC / cross training and TMA training, "Core" and Advanced Simulator lessons may be run in one block rather than separately

Training Phases

Orientation

Final Field Training	FPC / Cross Training	TMA Training
Pre-Course Pack	Pre-Course Pack	Pre-Course Pack
Induction		
Walk Through	Walk Through	Walk Through
Research (general)		
Research (specific)	Research (specific)	Research (specific)
MILESTONE 1	MILESTONE 1	MILESTONE 1

Core

Walk Through	Walk Through	Walk Through
Basic Radar (radar sector)	Basic Radar (radar sector)	Basic Radar
AACC Familiarisation	AACC Familiarisation	AACC Familiarisation
Simulator Modules	Simulator Modules	Simulator Modules
MILESTONE 2	MILESTONE 2	MILESTONE 2

Rating

OJT in AACC	OJT in AACC	OJT in AACC
Advanced Simulator	Advanced Simulator	Advanced Simulator

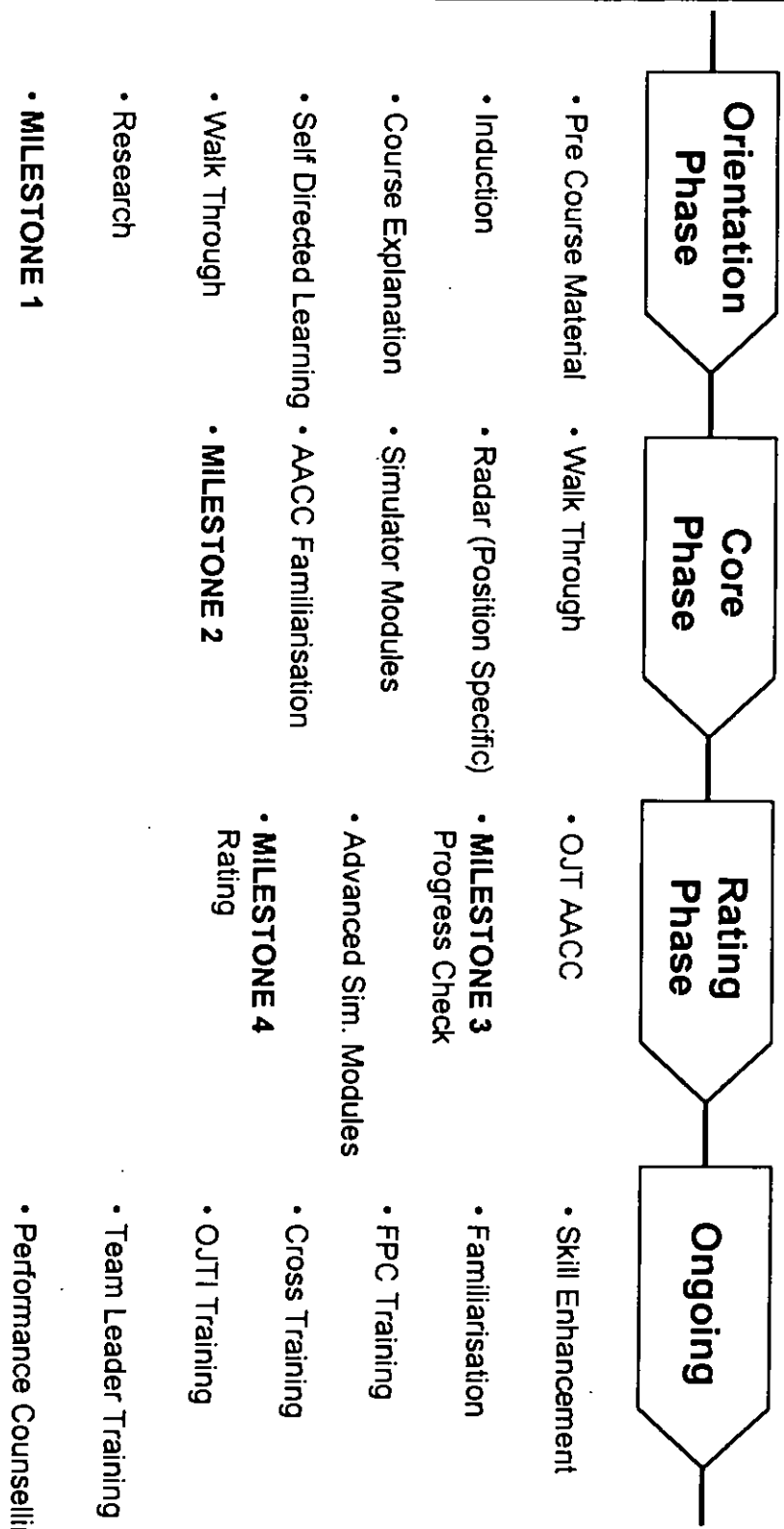
Addition

MILESTONE 3 (PROGRESS CK)	MILESTONE 3 (PROGRESS CK)	MILESTONE 3 (PROGRESS CK)
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Ongoing

MILESTONE 4	MILESTONE 4	MILESTONE 4
Ongoing Skill Training	Ongoing Skill Training	Ongoing Skill Training

Generic Training Course Process



The Orientation Phase

Introduction

The Orientation Phase consists of basic research involving orientation to the new position. This Phase is mainly knowledge based and consists of the following:

- Pre-Course Pack
 - Induction and Walk Through
 - Research (general)
 - Research (specific)
-

Pre-Course Pack

This Pack is handed out when students are allocated training. It is designed to give the students a focus for pre-course study and consists of the following :

- Notification of training
 - Name of Training Officer / Team Leader
 - Length of course / expected rating date
 - Expectations of trainee performance
 - Course objectives
 - Training program
 - Maps (overhead, frequencies, boundaries, adjoining sectors, PRD areas, FIS frequencies)
 - Local Operating Instructions
 - Rating Paper questions
 - Recommended reading guide
 - Initial roster.
-

Final Field Training Induction and Walk Through (2 days)

This part of the course applies to Final Field Training ONLY. The schedule for these two days is as follows:

- Welcome and introductions
 - Human Resources introduction (including rostering)
 - What are your learning needs ?
 - Course overview
 - Our expectations
-

Continued on next page

The Orientation Phase, continued

Induction and Walk Through continued

This section continues the schedule for the Final Field Training Induction and walk through.

- Self directed learning
 - Redress for learning
 - Amenities familiarisation (toilets, canteen etc) Lunch
 - Walk through on specific sectors
 - Tour of AACC and Simulator
 - Future plans (the changing ATC environment)
 - Explanation of FFT Resource Manual / Training
 - Walk Through continued
-

Research

Attached to an OJTI under the direction of the Team Leader of a position, or to a Simulator Shift Supervisor during which time research is carried out. The student gets to meet their team and familiarise with their specific position and the AACC.

Final Field Training Manual

The Final Field Training Manual includes the following :

- **Research Book** - This book is a student's guide to learning. It contains a list of questions to guide the student during the initial AACC attachment.
 - **Flight Following Exercises** - Flight following is a learning tool which follows the progress of flights through the airspace of a particular position. It provides, through student research, a knowledge base of frequency transfers, coordination points, strip markings, SAR, airspace details and aircraft performance. Using major air routes the student will also develop traffic handling and processing skills.
 - **Separation Exercises** - These are exercises that the student can work on alone or in a group and cover common separation problems encountered on their particular position.
 - **Techniques** - This is the study of the cognitive processes and methods used to successfully manage a specific ATC position. It provides the basis for learning an acceptable traffic planning and handling process.
 - **Simulator Runs** - In the research phase of Orientation the simulator is available to students who wish to practice what they have learnt so far in a safe environment free of the restrictions of the real world
 - **Workshops**. for ab initio courses workshops will be conducted on advanced strip marking, mental mathematics and circular slide rule calculations. These are to ensure that the trainee is up to the required speed in these tasks prior to commencing simulator training.
-

The Orientation Phase, continued

Feedback

In order to monitor a trainee's progress through training it is important to have a standardised assessment and reporting procedure in place. This makes it possible to deliver training material and resources to the areas where they are needed most. It also provides a method of reporting trainee progress and problem areas. From the trainer perspective it will serve to highlight those areas of the training program which are working well and those requiring modification.

The Orientation Phase is highly self-directed. It is considered beneficial to the trainee that at some point in this phase a feedback session with a member of the Training Centre be included. This is to ensure that the trainee understands what is required and is proceeding at a pace that will allow them to cover the required subjects in the allotted time. It also provides an opportunity for the trainee to identify any learning difficulties and to find a method of overcoming them. It is suggested that this feedback session is conducted approximately one third to half way through the allotted period.

Reporting

A report on the trainee's progress and any assistance required shall be sent to the Team Leader.

It is expected that on a daily basis during training the instructor will fill out a "Feedback Form" (see page 11 - 3) denoting areas of strength and weakness. The trainee and training officer will then jointly decide which areas require attention and develop a training strategy for the next day. This shall be entered on the Feedback Form.

Once a week the "Training Assessment / Debrief Form" (see page 11 - 5) shall be used and filled in by the OJTI. The trainee will then add comments and both shall sign the form. This form must also contain the training/remedial plan for the next simulator block.

Milestone 1 Assessment

At the end of this phase the trainee will undergo an assessment based on a number of flight following exercises. The trainee must demonstrate knowledge of strip annotation, coordination requirements, and frequency management requirements for 8 common flights through their area of responsibility. This will be assessed by the trainee correctly completing a Flight Following Proforma for the flights. The pass mark required is 80%.

The trainee must also successfully answer a selection of 25 questions, chosen by the Team Leader, from the list of potential Rating Paper questions. The pass mark is a minimum of 80%.

The trainee should pass Milestone 1 prior to beginning the "Core Phase" and must pass the milestone before the end of the first week of the "Core Phase".

Remedial Training

The sector Team Leader and OJTI, together with the trainee, must identify those work areas requiring remedial attention and advise the trainee and the ATS Specialist Support Training.

Should the trainee fail to pass Milestone 1 they must sit new examinations and if they fail, counselling will occur which may result in recommendation for termination of training.

The Core Phase

Introduction

Four weeks are allocated in this phase for Final Field Training but this will vary depending on the position's complexity.

This phase is primarily a simulation phase, and can be interspersed with periods of on-the-job instruction. Each training course must contain core lessons which cover those techniques and procedures deemed necessary, by the training centre and the team leaders, for the trainee to master.

It is envisaged that training will be structured to allow for "practice sessions" along the way to reinforce the lessons learned to that point. This will also allow the training officer to sit back and assess the trainee's retention of lesson material and point out strengths and weaknesses, and those areas requiring attention. The longer practice period at the end of training provides time for reinforcement of all points covered.

As the trainee progresses more on-the-job training can be introduced to assist in the transfer of skills to the "real life" environment. The success of simulator training will be dependant upon the teaching skills of the training officer.

Basic Radar Module

This is position-independent training, for students who do not hold a Melbourne radar rating, covering AUSCATS techniques. At present the Basic Radar Course is based on a generic piece of airspace. Lessons are structured for 2 to 4 trainees interacting with each other. It teaches AUSCATS theory, ADU familiarisation, keyboard and rolling ball skills, hand-off / accept, sequencing and vectoring skills.

Simulator Modules (1.75 hrs each)

These will be position specific lessons covering day to day traffic configurations which allow the student to build on their knowledge base by practicing in the simulator. Each module contains the following elements:

- Topic for the lesson (learning objectives / competencies)
- Flight following exercises (these refresh the memory and involve flights to be run in the lesson)
- Separation standards exercises (to be used in the lesson)
- Aircraft performance (memory refresher - aircraft used in the lesson)
- Quiz
- Simulator lesson
- Debrief (independent and group)

This structure allows for overlearning of the knowledge base and learning the basic skills required to operate the position to "normal traffic" standard.

Continued on next page

The Core Phase, continued

AACC Real-time Familiarisation

It is intended that periods of familiarisation at the workplace, interspersed with simulator sessions, will provide the student with a smooth transition and negate the "real-world vs simulator" shock.

Exercise Feedback

During this phase the OJTI should provide feedback, using the "Feedback Form", after every simulator exercise. The trainee shall also provide an assessment of their own performance. This should give a clear indication of each trainees strengths and weaknesses with strategies devised to overcome any perceived shortcomings.

Simulator Block Assessment

At the end of each week the trainee shall be assessed by the OJTI, using a "Training Assessment / Debrief Form", and be given a written debrief addressing all competency areas. This will provide the trainee with an indication of their overall performance during the simulator block.

Competency Areas

The competency areas for this unit are :

- Conflict Recognition
- Separation Assurance
- Traffic Handling and Workload Management
- Coordination
- Traffic Planning
- Radar Technique
- SAR Actions
- Stripwork
- Phraseology and Communication
- Equipment Handling
- Airspace Knowledge

The Trainee and Training Officer will agree on areas requiring remedial work and formulate an action plan to achieve progress in these areas. The problem areas and plan shall be entered on the form and signed by both the Trainee and Training Officer to signify agreement.

A copy of this assessment form shall be passed to the Team Leader, the ATS Specialist Support Training and to the EnRoute, TWR or TMA Manager.

Continued on next page

The Core Phase, continued

Team Leader Feedback

At some point during the Core Phase it is recommended that the Team Leader monitor or conduct a training session to provide feedback to the trainee on progress from the Team Leaders perspective. This will allow differences between the OJTI and Team Leaders views to become apparent at an early stage and provide the opportunity for discussion and providing a resolution for the trainee to overcome any difficulties.

Milestone 2 Assessment

At the end of the Core Phase, and prior to commencing on-the-job training, the trainee will be assessed using a simulator exercise based on "a normal days traffic". The traffic will be based upon the average number of aircraft during the busiest hour, taken from "real time" traffic sampling, and will include "key" conflictions for that position to ensure testing of core competencies. This will indicate whether the trainee is capable of handling high density traffic with low complexity in the AACC and is ready to commence on-the-job training.

All milestone exercises will be validated by the Team Leaders and Stream Specialist for the position.

The assessed exercise will allow grading of competency areas on a scale of 1 to 5, with 1 being the lowest and 5 being the highest. (Refer to Competency Areas - Grading Criteria on page 8 - 1).

Four areas of competency are critical for a pass grade. They are stated below, together with the minimum allowable score :

- Conflict Recognition 5 (100%)
- Separation Assurance 5 (100%)
- Coordination 5 (100%)
- Traffic Handling & Workload Management 3

Failure in any one of these competency areas will result in a fail for the assessed exercise.

The Team Leader shall send a copy of the assessment to the Enroute, TWR, or TMA Manager, and the ATS Specialist Support Training.

The Trainee must pass Milestone 2 prior to beginning the "Rating Phase".

Extensions and Remedial Training

Should a Trainee fail a Milestone 2 assessment a maximum extension period of two weeks will be scheduled to implement a remedial training plan. The Team Leader, OJTI and Simulator Supervisor, together with the Trainee, must identify those work areas requiring remedial attention and advise the ATS Specialist Support Training.

This will be followed by another assessed exercise which shall be a different exercise to that originally used.

The Core Phase, continued

Extensions and Remedial Training, continued

If the Trainee fails to meet the stated criteria, the ATS Specialist Support Training, Team Leader, Training Officer and ATS HR manager will review all Trainee performance information, including Debrief Forms, to consider termination of training.

Remedial Training

Success

Progress to next stage
of training or rating

Recognise problem

OJTI, Trainee

Failure

Recommendation for
termination of training

Apply plan

OJTI, Trainee

Identify problem

OJTI, Trainee, TTS

Determine plan

OJTI, Trainee, TTS with
Educational specialist,
ATC Training Specialist

The Rating Phase

Introduction

The Rating Phase involves on-the-job training working at the particular position with an instructor and practicing skills already learnt, and learning advanced skills to handle unusual traffic, weather diversions, emergencies and very busy periods.

Advanced simulator sessions give the Trainee the opportunity to encounter situations which they may not meet in their training at the console. These will include the situations described above.

Feedback

The OJTI will provide the trainee with daily feedback during on-the-job training, using the "Feedback Form", and an assessment shall be made using the "Training Assessment / Debrief Form" at the end of each week indicating whether the trainee is reaching targets, and defining areas where more work is required.

Any advanced simulator sessions will be followed by feedback sessions and completion of a "Feedback Form".

A copy of these shall be forwarded to the Team Leader.

Milestone 3 Progress Check Assessment and Extension

It is recommended that the Team Leader conduct a Progress Check at approximately the half way point through the Rating Phase and fill in a "Training Assessment / Debrief Form". A copy of this assessment shall be forwarded to the Enroute, TWR, or TMA Manager and the ATS Specialist Support Training.

If any weaknesses are apparent at this stage the Team Leader and OJTI will consult with the Trainee and the ATS Specialist Support Training and devise a remedial training strategy to overcome these weaknesses and set a target for Milestone 4. A maximum extension period of up to 2 weeks will be programmed for remedial training if required.

Milestone 4 Assessment

At the end of the Rating Phase the Trainee will undergo Final Checks for Rating on the position. The Team Leader responsible for the Trainee shall assess them over a period of at least 2 shifts and covering all key competency areas. If the shifts chosen for checking the Trainee do not provide the opportunity to assess all key competency areas, the Team Leader will either extend the check, or book an approved assessment exercise in the simulator which provides access to those situations requiring assessment. The OJTI shall provide a report on trainee progress over the training period to the Team Leader to assist with trainee evaluation

The Trainee will be assessed using the same criteria as used for Milestones 2 and 3.

The Team Leader will use the "Training Assessment / Debrief Form", and a copy of this assessment shall be forwarded to the Enroute, TWR, or TMA Manager and the ATS Specialist Support Training.

Continued on next page

The Rating Phase, continued

Extensions and Remedial Training, continued

If the Trainee does not meet the required standard during Final Checks, a maximum extension period of up to 2 weeks will be scheduled for remedial training. This will vary from position to position, dependant upon job complexity.

A remedial training strategy shall be decided upon by the Team Leader, OJTI and Trainee in conjunction with the ATS Specialist Support Training.

The Trainee will then undergo another Final Check and if the required standard is still not achieved then the following will occur:

For Abinitio Trainees	A report recommending termination of training will be forwarded to Canberra for approval,
For Cross Training	Reallocation as decided by the releveant Manager.

Ongoing Skill Enhancement

Introduction

This assumes that when the controller is rated on a position there is still room for enhancement of their skills.

Examples of opportunities for ongoing improvement are:

- Advanced simulator lessons
 - OJTI training
 - Trainer development
 - FPC training
 - Computer courses
 - Coaching skills
-

Competency Areas: Grading Criteria

Introduction	The Grading Levels will be further clarified by the Educational Specialist.	
Conflict Recognition	This assesses the trainee's ability to recognise potential conflictions given various traffic configurations. The trainee must recognise conflictions during strip placement in the Flight Progress Board, from pending traffic and knowledge of the effect it will have on active traffic, and from the interaction of active traffic.	
Grading	1	Failed to recognise conflictions, leading to major breakdowns.
	3	Recognised ALL conflictions, but was sometimes rushed in that recognition causing difficulties in the consequent resolution.
	5	Recognised ALL conflictions, the early recognition of which allowed for efficient and safe resolutions at all times.
Separation Assurance	The trainee must possess the ability to identify options for separation that can be safely applied and are appropriate to the situation presented. The trainee must have knowledge of all applicable separation standards - departure standards, longitudinal time and distance standards, lateral separation, vertical separation, and area navigation standards. The trainee must be able to calculate times of entry to and exit from areas of conflict, and times of passing.	
Grading	1	Rarely produced safe solutions, leading to major breakdowns of separation.
	3	Produced SAFE solutions to ALL conflictions but did not always select the most effective and time efficient solution.
	5	Produced SAFE solutions to ALL conflictions by considering the options early and then selecting the most appropriate alternative that provided separation assurance.
Traffic Handling and Workload Management	The trainee must demonstrate the application of a logical work plan based on current and incoming information, so that tasks are prioritised and completed in a manner so as to minimise workload, delays to aircraft, and delays to other units. This work plan must incorporate task prioritisation, decision making and implementation, plan revision and teamwork. The trainee should be able to demonstrate a recognition of the need to adapt workload management techniques, and display the ability to adapt these techniques as required to cope with changing traffic density and/or complexity.	
Grading	1	The trainee was unable to process information in such a way so as to manage workload or avoid delays. The work method was haphazard, leading to significant difficulties in decision making or prioritising. Work rate was too slow and little ability to adjust to increasing work rate was evident.
	3	The trainee demonstrated an ability to process information correctly, prioritise tasks, and implement a plan to minimise workload and delays. Any difficulties were due to problems in adequately adjusting work rate or methods to cope with increasing workload or complexity.
	5	The trainee was, at all times, able to adjust methodology and work rate to cope with workload demands and avoid any delays. Prioritisation, decision implementation, and task completion were carried out so as to maximise planning time.

Continued on next page

Competency Areas: Grading Criteria, continued

Coordination	The trainee must ensure that all coordination for routine traffic is completed accurately within the correct time. The trainee must be able to determine correct coordination requirements for non-routine operations involving irregular flights, diversions and emergency or abnormal operations. The trainee must use key words to initiate coordination.
Grading	<ol style="list-style-type: none">1 Frequent errors were made including excessive information, omissions, incorrect information, inappropriate or ambiguous phraseology, and late coordination.3 Coordinated ALL routine traffic correctly and on time. Non-routine traffic was coordinated, but was not done in the most time efficient and non-ambiguous manner.5 ALL coordination was correct and completed on time, without any ambiguity or misunderstanding.
Traffic Planning	This assesses the trainee's ability to use all available data to anticipate the actions required in order to process various traffic patterns including - pending departures sequence, pending arriving sequence, crossing traffic, opposite direction traffic, and aircraft entering from OCTA. The trainee must be able to identify conflicting tracks, and be able to identify future work and problems. The trainee must demonstrate a thorough knowledge of aircraft performance.
Grading	<ol style="list-style-type: none">1 Unprepared for simple and probable changes in traffic patterns. No methodical approach to planning was demonstrated.3 Planned ahead and adopted a methodical approach to various situations presented, however failure to consider all options resulted in a higher than necessary workload.5 All situations were planned in advance and alternatives considered. Traffic predictions and strategies were continuously reviewed and amended as necessary, in adequate time for efficient implementation.
Radar Technique	The trainee must be able to correctly identify aircraft and verify level readouts, be able to correctly apply the radar separation standards, and vector aircraft and terminate vectors correctly. The trainee must be able to establish procedural separation in the event of radar failure. The trainee must be able to correctly vector aircraft for sequencing.
Grading	<ol style="list-style-type: none">1 Poor identification/verification and/or vectoring techniques. Did not use radar to improve traffic flow or resolve problems.3 No errors in identification and verification procedures. Little use of radar was made to actually facilitate and expedite traffic.5 Radar used to maximum potential to facilitate and enhance traffic flow. Potential problems were anticipated early and dealt with efficiently. Effective vectoring.

Continued on next page

Competency Areas - Grading Criteria, continued

SAR Actions

The trainee must calculate and annotate SARtimes correctly and initiate communication checks within the required time. The trainee must declare the appropriate phase for the given circumstance within the required time by an appropriate phase declaration method, and complete tasks in the correct priority associated with the emergency.

Grading

- 1 Failed to respond to abnormal situations. Failed to monitor SARtimes and communication checks were not performed in the required time.
 - 3 SARtimes were continuously monitored to ensure that communication checks were carried out on time. A correct initial response to SAR/abnormal situations, however there was insufficient investigation of the events.
 - 5 Correct priority was given to SAR/abnormal situations, reacting quickly and analysing all aspects of the situation with consequent correct responses. SARtimes were at all times maintained with 100% accuracy.
-

Stripwork

The trainee must maintain an accurate and legible display at all times and must annotate strips correctly whilst both listening and talking. Must be able to check strips for accuracy before placement into the flight progress board. The trainee must integrate strips into the flight progress board as soon as possible and remove obsolete strips promptly.

Grading

- 1 Did not maintain a functional and effective display.
 - 3 Display was accurate, clear and generally up-to-date with only minor errors. Did not base instructions to aircraft on incorrectly displayed information.
 - 5 At all times display was accurate, updated promptly, and all information was clear and unambiguous. Stripwork was performed in an expeditious manner.
-

Phraseology & Communication

The trainee must use standard phrases as applicable and be able to use non-standard phrases in unusual situations with the intended meaning communicated. The trainee must be able to use clear and correct speech without pregnant pauses, inappropriate inflections or emphasis, or clipped transmissions.

Grading

- 1 Poor or incorrect use of standard phraseology, resulting in indistinct and hesitant delivery.
 - 3 Standard phraseology used effectively with only minor errors. A basic ability was as demonstrated with non-standard phraseology, however exaggerated transmissions resulted. Delivery was usually clear and concise.
 - 5 Use of standard phraseology was automatic and non-standard phraseology was effectively used, resulting in clear, unambiguous delivery at all times.
-

Continued on next page

Competency Areas - Grading Criteria, continued

Equipment Handling

The trainee must be able to use all interconsole communication channels effectively, manage interruptions and receive multiple inputs from both intercom and air-ground facilities. Must be able to determine correct priorities in answering calls and be able to use the backup systems in the event of equipment failure. The trainee must be able to competently manipulate the equipment applicable to the operating position.

Grading

- | | | | |
|---|--|---|---|
| 1 | Unable to use equipment effectively. | — | — |
| 3 | Demonstrated rudimentary use of the equipment. | - | |
| 5 | Sound understanding and optimum use of equipment at all times. | | |
-

Airspace Knowledge

The trainee must be able to demonstrate a knowledge of the airspace appropriate to their position including - the lateral and vertical limits and the CTA steps, the location of primary navigation aids, restricted airspace, and the adjacent units.

Grading

- | | |
|---|--|
| 1 | Lack of knowledge of airspace and facilities affected performance. Constant referral to maps for even the most basic of detail. |
| 3 | Sufficient knowledge to perform satisfactorily. Intimate detail was lacking, hampering performance during complex and busier situations. |
| 5 | A thorough knowledge of all aspects of, and facilities contained within the airspace was demonstrated. |
-

Course Evaluation

Introduction

During the running of a course, reports of trainee progress will be regularly sent to the ATS Specialist Support Training. These will be monitored to ensure trainees receive remedial training at an early stage and to highlight deficiencies in the training material or in training delivery.

At the end of each course a "Course Evaluation Form" will be sent to each Trainee and Training Officer. The returned forms will be processed and improvements will be made to exercise content or course structure where considered justified. The decision to alter course material will be made by Training Centre staff in consultation with Team Leaders.

Constant Improvement

The evaluation forms will be kept on file and the bank of data monitored to assess trends in course strengths and weaknesses in order to constantly improve the overall Training Centre System (refer to Quality System Manual).

The "Course Evaluation Form" can be found on page 11 - 10.

Checklist for OJTI's Developing Training Courses

Introduction

In an effort to standardise on a system for the development of all training courses offered by the Southern District Office Training Centre, this set of guidelines is to be used by instructors when they write a new course. This will enable the Training Centre to offer a consistent format and keep all vital documentation up to date. It will also make the entire process more efficient and consistent with the Training Model.

The guidelines contain the general headings and sub headings for areas which need to be covered during the course and are layed out in a logical progression. Not all sections will need to be covered in detail on every course (for instance, the radar section may not be applicable to a fully procedural sector) however, it may be touched upon lightly in reference to an adjoining sector where it has some effect on the operation of the sector for which the course is being written.

In addition to these guidelines, a set of blank template sheets are available so that the actual course detail can be entered into a standard layout.

Facilities

- ☐ Console layout
 - ☐ Layout of procedural board
 - ☐ EDDS display
 - ☐ Clock
 - ☐ Audio systems
 - ☐ Concentrating jurisdiction

 - ☐ Radar Sensors - location, type, range, gaps in coverage
 - ☐ Bypass radar input
 - ☐ Adjacent sector's radar display - type, sensor input, SSR input, limitations
 - ☐ Setup of radar display
 - ☐ Radar maps available
 - ☐ Private maps
 - ☐ Adhoc maps available
 - ☐ Map tolerances
 - ☐ OPDATA line
 - ☐ Forced correlation

 - ☐ SSR - skin codes, semi-permanent codes, bin codes, emergency codes
 - ☐ Identification and verification of Mode C

 - ☐ Communications - primary, secondary & tertiary frequencies
 - ☐ Operation of Sec link
 - ☐ Frequencies used by adjacent sectors
 - ☐ Transferring frequencies to other consoles
-

Continued on next page

Checklist for OJTI's Developing Training Courses, continued

-
- | | |
|-----------------|---|
| Airspace | <input type="checkbox"/> Boundaries : lateral and vertical |
| | <input type="checkbox"/> Level of responsibility within airspace - Control, RAS, FIS |
| | <input type="checkbox"/> TMA's and TWR's associated with airspace |
| | <input type="checkbox"/> Restricted Areas affecting airspace - lateral and vertical, activation |
| | <input type="checkbox"/> Significant locations |
| | <input type="checkbox"/> Radar coverage |
| | <input type="checkbox"/> Adjacent airspaces |
-

- | | |
|------------------------------------|--|
| Route Structure and Navaids | <input type="checkbox"/> Review route structure |
| | <input type="checkbox"/> Most frequently used routes |
| | <input type="checkbox"/> Navaids - location, type, ranges, limitations |
-

- | | |
|---------------------|---|
| Coordination | <input type="checkbox"/> Coldlines, Hotlines, Satellite lines, Land lines |
| | <input type="checkbox"/> ICM's |
| | <input type="checkbox"/> Silent hand-offs - radar |
| | <input type="checkbox"/> Transfer points |
| | <input type="checkbox"/> Check estimates |
| | <input type="checkbox"/> Revised estimates |
-

- | | |
|-------------------|---|
| Separation | <input type="checkbox"/> Most used Separation Standards within airspace |
| | <input type="checkbox"/> Longitudinal Standards - Time, DME, RNAV |
| | <input type="checkbox"/> Lateral Separation - Lat Sep diagrams, effect of U/S navaids, |
| | <input type="checkbox"/> Using radar BRL |
| | <input type="checkbox"/> Vertical Separation - standard, during weather diversions |
| | <input type="checkbox"/> Radar Standards |
| | <input type="checkbox"/> Radar U/S procedures |
| | <input type="checkbox"/> Assisting other non-radar equipped units with radar separation |
-

- | | |
|----------------------|--|
| RAS & FIS | <input type="checkbox"/> See AIP SUP H69/94 |
| | <input type="checkbox"/> Boundaries : lateral and vertical of RAS/FIS area |
| | <input type="checkbox"/> Provision of RAS & FIS |
| | <input type="checkbox"/> Radio Procedures |
-

Continued on next page

Checklist for OJTI's Developing Training Courses, continued

Traffic Management

- ☐ First Principle : Where is the aircraft going ?
Who is potentially in conflict ?
Who needs to know about the aircraft ?
 - ☐ Discuss options for frequently occurring conflicts
 - ☐ Sequencing procedures
 - ☐ Strategies for holding - published and non-published patterns
 - ☐ Strategies for weather diversions
 - ☐ STARS
 - ☐ Traffic priorities
-

Workload Management

- ☐ Opening and closing radar console
 - ☐ Opening and closing procedural console
 - ☐ Coordination assistance
 - ☐ Identifying personal triggers for when to request assistance
- before it's too late !!
 - ☐ Order of response to Acft / Hotline / Coldline
 - ☐ Preference for "Set and Forget" solutions
 - ☐ "Acceptable" abbreviated phraseologies
 - ☐ Handing off acft early
 - ☐ Standard distances/times to run for estimates
 - ☐ Annotate coord on strips before putting them on the board
 - ☐ Relay of ATIS to acft and phraseologies
 - ☐ Keyboard / ADU knowledge
-

SAR

- ☐ IFER manual
-

General

- ☐ Handover - Takeover procedures
 - ☐ LOI's, AIC's, Standardisation Items .
 - ☐ Information Folders
-

Proforma 3



Civil Aviation Authority
AUSTRALIA

SESSION FEEDBACK FORM

OJT ☐
SIM ☐

Trainee:	Instructor/ Training Officer:	Sector: Exercise:	Date:
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Today's Topics / Reviews:

Exercise Observations:
(Points arising from simulator / on-the-job observation)

Recommendations:
(Agreed goal achieving areas)

Trainee Comment:
(Trainee's thoughts on session)

(PTO for further Observations, Recommendations or Comment)

<input type="checkbox"/> A lot more work required	<input type="checkbox"/> Extra work required	<input type="checkbox"/> Working well	<input type="checkbox"/> Working above expectation
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Proforma 4



Civil Aviation Authority
AUSTRALIA

Week:
Milestone:

Training Assessment Debrief Form

Trainee:	Instructor/ Training Officer:	Position:	Date:
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Conflict Recognition

F 1 2 3 4 5

Strip placement

Assessing pending traffic

Interaction of active traffic

Change of standards (DME, RNAV, etc.)

Separation Assurance

F 1 2 3 4 5

Vertical separation

Identifies options

Lateral separation

Selects best option

Longitudinal separation

Calculation of lateral separation

Workload and Traffic Management

F 1 2 3 4 5

Takes position reports

Aware of pending traffic

Uses defensive techniques when overloaded

Sufficient speed

Applies correct priorities

Knows/applies operating characteristics of aircraft operating in Aust.

Assigns timely descent

Monitors SAR times

Displays knowledge of wx effect on acft. performance

Minimises callbacks

Coordination

F 1 2 3 4 5

Correct coordination for unusual traffic

Coordination completed in time

Traffic Planning

F 1 2 3 4 5

Pending departures
Knows acft. performance
Pending OCTA departures

Identifies conflicting tracks
Sequences
Knows common frequencies

Opposite direction passing
Anticipates next action

Radar Technique

F 1 2 3 4 5

Identification / verification
Radar separation
Vector termination

Establishes procedural separation
Position reports / amended estimates
Radar failure procedures

IFER

F 1 2 3 4 5

Appropriate phase on time

Priority to SAR situation

Stripwork

F 1 2 3 4 5

Position reports
Clearance issue
Tick readbacks

Strip annotation whilst talking
Calculates and annotates SAR times
Clarity and accuracy

Coordination prompts

Phraseology and Communication

F 1 2 3 4 5

Uses standard phraseology
Uses standby / call-back
Uses key words to initiate call

Clear concise delivery
Confident delivery, ad-libs well
No pauses or inflections

Documents, Procedures and Airspace Knowledge**F 1 2 3 4 5**MATS / MATS Supp / LOI
Restricted areasLateral and vertical limits
Radar map**Equipment Handling****F 1 2 3 4 5**Manages interruptions
ADU setup / console familiarity

Intercom and a/g management

Handover / Takeover**F 1 2 3 4 5**Traffic disposition
NOTAMS / weather / airspaceEquipment / frequencies
Outstanding items**Teamwork**

Communication with partner

Cooperation / teamwork

Trainee Comments**Training Officer Comments**

Areas identified as requiring more work

Action plan for remedial training

**Trainee's
Signature**

**Training Officer's
Signature**

(This signifies agreement with the remedial program by both parties.)

Instructions for using this form:

- This form is to be filled out:
 - at the end of each week of training
 - at the Simulator Course completion milestone (Milestone 2)
 - and – at the Progress Check milestone (Milestone 3).

For Weekly Assessments:

- Each of the key competency strands shall be graded from 1 – 5 for weekly assessments. The 'F' grading is not required for these assessments.
- A grading of 3 – 5 shall be considered satisfactory
A grading of 1 or 2 shall be considered unsatisfactory and a remedial action plan shall be implemented

For Milestone Assessments:

- The 'F' grading shall be used (if necessary) in assessments at Milestone stages. During a Milestone stage assessment, an 'F' grading shall be used in lieu of a grading of 1 or 2, and shall indicate that a formal remedial plan is required.
- A grading of 3 – 5 shall be considered a pass
(noted key competencies require a grading of 5 for a pass)
A grading of 'F' shall be considered as failure and shall instigate a remedial action plan. After the remedial action and following a second assessment, failure may result in recommendation for termination.

Appendix 11

Selection of war stories narrated by air traffic controllers

APPENDIX 10 - SELECTION OF WAR STORIES NARRATED BY CONTROLLERS

1. The breakdown of the labouring body

A great war story, but true. He'd had a morning shift followed by a doggo. And he'd done the morning shift in Sydney tower in 1957. And he went home and had a sleep but was due at a friends place for dinner that night. He didn't want to go. He wanted to sleep because he was back in the tower at 11 that night. They were committed to going out to dinner and when he got to his friends place, somewhere around Bondi or somewhere, and aircraft were coming over the top all the time. And he was sitting there listening to these aeroplanes going over and he made several references to '*those bloody aircraft*' and he'd just had enough of '*those bloody aircraft*'. And after dinner he got extremely tired and he lay down on the sofa to have a rest. He was going to drive straight to work following dinner and he had this breakdown where he couldn't move. Couldn't get up, just couldn't face it any more.

2 One too many airborne

I have always learnt from that one about one too many airborne. That was a long time ago now. It must be 15-20 years old. / There was the two of them doing Brisbane approach and that is exactly what happened. He just got one too many airborne and he didn't have anywhere to put it [the aircraft]. They reckon he just leant over to the other bloke and put his hand on his shoulder and in his broad Scottish accent, he said '*I've got one too many airborne. I am going to have to come over here*' sort of thing. The other bloke was '*oooohhhh*'. You learn from that though and you go '*One too many airborne*' and as soon as you get really busy launching all these aeroplanes and they [controllers in the tower] go '*next*' and you are going '*where am I going to put him to go? Have I got one too many airborne?*' and you say '*Nothing for you*'. It gives you the strength to say to the tower '*Forget it*'. That takes a long time to come.

3. Six in the circuit and the jets are coming in.

Most of the war stories we relate to are usually excitement in the workplace or something that was humorous or dangerous or something like that. I was training someone. It is how you get caught out in this job. It was Sunday morning. There was a couple of guys [controllers] on breaks and I was training a guy. So we had one position combined¹ and a guy [controller] sitting in a position [who] hadn't been doing it that long. [The controller] was rated on that [sector] - but he had a very casual approach and may have been doing the crossword. And I was the Team Leader so I was training the other guy there. And the other [controller] was downstairs - having a cigarette or something. So he had to go outside the building.

And the guy I was training, I was giving him an idea of what aerodrome control was like. And I had all this airspace released to me. And there were three or four aeroplanes doing circuit training² right?. [Name of Centre] is an international airport, and usually you don't have aircraft doing circuit training there, you're allowed to / and we had 3 or 4 doing - all different types of aeroplanes - like high performance twin engine aeroplanes, jet type aeroplanes and little light 150-type aeroplanes

And then another one asked to do it. And the guy I was training, he said, *'oh, that's probably too much?'* and I said, *'no it's Sunday morning, it's fine'*, you know *'bring it on in'*. And an aircraft came back from the training area, another little light aeroplane, he wanted to do circuits, and I said, *'yeah that's fine'*. And [the trainee] said *'oh, but that means we'll have six aeroplanes doing circuits?'*. And as he did that, the hot line went from approach, and the guy downstairs who was a bit of a cynical bloke, so I said, *"'ts okay, we can have that many in a circuit because, as long as there's no jets'*. And the guy asked me about another aircraft that was coming in and I gave

¹ when the workload is slow, two sectors can be combined to create one sector, canaged by one controller. When the work traffic becomes heavy, the sectors are "decombined" creating two sectors. Sometimes sectors are combined to give the trainee or controller exposure to a higher workload than normal, though in this instance, the secotrs were combined due to the light traffic load.

² Aircraft undertaking circuit training are practising take off and landing, without stopping. Typically the pilot will "land" by touching the wheels of the aircraft on the tarmac and then taking off again. These are generally light aircraft and they maintain their own separation standards by visual means.

'unrestricted' and then hang up. And then it got a bit busy. And the trainee, the guy who was doing it, he'd lost the picture, so I took over. As I'm doing it, this guy, the controller with the very casual approach to things, he walks up [from being outside] the tower and says *'Hey buddy, what are you going to do with that guy out there with all these guys in the circuit?'* and I said, *'That's alright, I'll just put him in at 1500 feet and drop him through the two cessna's out there'*, and he says, *'ah nup - [name of narrator] - that's a 747!'*

And I looked up and there's this big tail fin, coming around the corner. And this other [controller] had put this guy [aircraft] above my circuit training, in a non-standard flight path, and hadn't told me about it. He had written it on the strip. The guy who was doing the crossword [also] hadn't told me, and we all turned around, and here was this big fin - it was just like out of "Flying High", coming around the corner.

And for the next twenty-five minutes — well, just at that time, I'd said to them [approach/departures] *'let me know if there's anyone who's going to push back'*. And [I looked and] there's a Cathay 747 taxiing down for a back-track for the runway. He's going to Hong Kong. And then I looked on the screen. Because it had been so busy, I had the screen down small, and I blew the screen out to see if there was anything else coming, and there's [another] two jets coming straight onto approach. So for the next twenty-five minutes, no-one said anything, 'cause I just told 'em all what to do. I had six light aeroplanes, that were meant to be doing circuit training— I put them all onto holding points. And all the time this bloke downstairs says *'are you going to be ready for this next one - departure - do you want it? Do ya?'* He kept on interrupting, and I was trying to talk all the time. It was just ah.

We were talking about how sometimes, people take more than they should, and I had done that. I was caught out and I was supposed to be an experienced controller training someone and so for the next four months, every time a jet came into [name of Centre] and it was Sunday morning, every guy on approach would hit the line and say *'remember you can only have six in the circuit when you've got jets coming in'* and then hang up.

They all did it to me. From then on, people were careful on Sunday mornings just like every other time, because my story got told a number of times.

But that's the thing. It's usually related to something that people had a reasonable excitement or had been caught out and I had been caught out. And that's the way you learn. That guy who was training. He saw me as being an Ace at the job and he saw me get caught out. 'It sort of came back to him. And the [controller] who didn't coordinate - the [aircraft] who was coming around the corner at me, I actually counselled him over that. *'I may have had too many aeroplanes, but you're meant to tell me what's going on'*. From then on, he never did the crosswords any more, (because, he [had thought he] didn't have anything to do because all the circuit training doesn't get coordinated). But he realised that that job was a lot more important than he thought it was. And he got caught out. The whole thing was, everything was safe, it was just that a whole lot of aeroplanes, that weren't getting told that they were getting delayed, would have got delayed. And I just stood them all out of the way, and all of the jets got in, but these other guys, who had gone up to do circuits, they were at a fair disadvantage. They were going around in circles over different holding points until I could bring them in..

And no-one complained ('cause they could hear me shouting). They are the usual type of warrie - people learn from them.